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RF/RMRS- 97-010

FINAL SITE SPECIFIC HEALTH AND SAFETY PLAN FOR THE SOURCE REMOVAL AT TRENCH 1 IHSS 108

APRIL 1998

Reviewed for Classification:
CEX-010-98

Site Specific Health and Safety Plan for the Source Removal at Trench 1 IHSS 108

Rocky Mountain Remediation Services, L.L.C.

APRIL 1998

ADMINISTRATIVE INFORMATION

Site: Rocky Flats Environmental Technology Site (RFETS), Golden, Colorado

Project Name: Source Removal at Trench 1 - IHSS 108

Date Prepared: April 29, 1998

Approvals

I have read and approved this HASP with respect to project hazards and regulatory requirements.

Wayne R Sproles — 4/29/98
Wayne Sproles, RMRS Project Manager — Date

Ruth McCafferty — 4/29/98
Ruth McCafferty, RMRS Industrial Hygiene Team Lead — Date

Dave Farler — 4/29/98
Dave Farler, RMRS Health and Safety Supervisor — Date

Ken Gillespie — 4/29/98
Ken Gillespie, RMRS Site Safety Officer — Date

FOR — 4.29.98
Greg DiGregorio, RMRS Quality Assurance — Date

4-29-98
Peggy Schreckengast, RMRS Industrial Hygiene — Date

4/29/98
John Miller, RMRS Radiological Engineering — Date

Don Barbour, Starmet Project Manager — Date

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- *Hazardous Materials Toxicology*, J. B. Sullivan, Jr. & G. R. Krieger, Williams & Wilkins, Baltimore, MD, 1992
- Kaiser-Hill, *Chronic Beryllium Disease Prevention Program*
- *NIOSH Pocket Guide to Chemical Hazards,* 1997
- NIOSH/OSHA/USCG/EPA *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*
- *Occupational Diseases, A Guide To Their Recognition*, NIOSH, 1977
- OSHA Title 10 CFR 835 *Occupational Radiation Protection*
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- *Primer on Spontaneous Heating and Pyrophoricity*, DOE-HDBK-108-94, December 1994
- *Pyrophoric Metals Fire Extinguishment*, Fire Emergency General Operating Guidelines, 3-FES-GOG-229
- Rocky Mountain Remediation Services *Final Proposed Action Memorandum for the Source Removal at Trench 1, IHSS 108 (PAM).*
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- Rocky Flats Environmental Technologies Site *Health and Safety Practices Manual*
- Rocky Flats Environmental Technologies Site *Integrated Safety Management Systems Manual*
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- Section 01700-1 *Subcontractor Health and Safety Requirements (9/23/96)*
- Starmet Corporation *Sampling and Analysis Plan (SAP)*

LIST OF ACRONYMS

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
CA	Contamination Area
COC	Chemical of Concern
CPM	Counts Per Minute
CRZ	Contamination Reduction Zone
CSFS	Contaminated Soil Feed Stockpile
DAC	Derived Air Concentration
dB	Decibels
DOE	Department of Energy
EZ	Exclusion Zone
FID	Flame Ionization Detector
FIDLER	Field Instrument for the Detection of Low Energy Radiation
FO	Field Operations Manual
FSO	Fire Safety Officer
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HCA	High Contamination Area
HEPA	High Efficiency Particulate Filter
HSP	Health and Safety Practices Manual
HSS	Health and Safety Specialist
IHSS	Individual Hazardous Substance Site
KH	Kaiser-Hill
MDC	Minimal Detectable Counts
MSDS	Material Safety Data Sheet
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PAM	Proposed Action Memorandum
pCi/g	Pico Curies Per Gram
PID	Photoionization Detector
PPE	Personal Protective Equipment
PPM	Parts Per Million
RCT	Radiological Control Technician
RBA	Radiological Buffer Area
RFETS	Rocky Flats Environmental Technology Site
RMA	Radioactive Material Area
ROI	Radiological Operating Instructions Manual
RMRS	Rocky Mountain Remediation Services L.L.C.
RSTS	Radiological Safety Technical Supervisor
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan
SCBA	Self Contained Breathing Apparatus

LIST OF ACRONYMS (cont.)

SIP	Sampling and Inerting Pad
SSO	Site Safety Officer
SSOC	Safe Sites of Colorado
SVOC	Semi-Volatile Organic Compound
TDU	Thermal Desorption Unit
VOC	Volatile Organic Compound
WBGT	Wet Bulb Globe Thermometer

1.0 INTRODUCTION

This site specific Health and Safety Plan (HASP) addresses the hazards associated with each phase of site operation and establishes guidelines to protect project personnel, collocated workers, the general public, equipment, and the environment during the implementation of field activities associated with the Source Removal at Trench 1, Individual Hazardous Substance Site (IHSS) 108.

Remediation of Trench 1 will consist of removing and stabilizing depleted uranium from the trench and removing and treating, if necessary, debris, contaminated soils, and other material that may be contained in the trench. Trench 1 is located in the Buffer Zone Operable Unit. When the IHSSs were recently ranked in order of threat to the environment, Trench 1 ranked number five of over 200 sites because it is the single largest volume of radioactive contaminants buried at Rocky Flats Environmental Technology Site (RFETS). Remediation of Trench 1 supports the overall RFETS mission of reducing risk to future users of the site and will be conducted under the authority of the *Safety Analysis for Individual Hazardous Substance Site (IHSS) 108, Trench 1 (T-1) Source Removal Project,* the *Final Proposed Action Memorandum for the Source Removal at Trench 1, IHSS 108 (PAM),* and the *Final Site Specific Health and Safety Plan for the Source Removal at Trench 1 IHSS 108.*

Radiological and hazardous waste work activities required to accomplish the remediation of Trench 1 will be conducted in accordance with the regulations and guidelines outlined in Department of Energy (DOE) Title 10 CFR 835, *Occupational Radiation Protection,* and Occupational Safety and Health Administration (OSHA) Title 29 CFR 1926.65 *Hazardous Waste Operations and Emergency Response.* When not addressed in DOE Title 10 CFR 835 or OSHA Title 29 CFR 1926.65, all work will be performed in accordance with DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees* and DOE/EH-0256T *U.S. Department of Energy Radiological Control Manual.*

The specific activities to be performed are defined in Section 4.0 of this HASP. The health and safety controls and requirements to be implemented are based on a review of available information and an evaluation of potential hazards in accordance with the RFETS *Integrated Safety Management Systems Manual.*

Revisions to this HASP require approval from the RMRS Project Manager or designee and the appropriate affected/required organizations and disciplines.

This HASP applies to Rocky Flats Environmental Technology Site contractors, subcontractors, and visitors involved in operations, management, or administration at the Trench 1 site. All users of this plan should obtain the most recent controlled copy prior to work at the site.

2.0 PROJECT PERSONNEL RESPONSIBILITIES

Each person is responsible for the health and safety of themselves and their coworkers, for completing tasks in a safe manner, and for reporting any unsafe acts or unanticipated hazards or conditions. All personnel are responsible for continuous adherence to this HASP during the performance of their work. No person may work in a manner that conflicts with the safety and environmental precautions expressed in this document.

The responsibilities and authorities of each individual relating to health and safety issues are presented in Operations Order No. 00-T1-02 *Organization, Roles and Responsibilities for Trench 1 Source Removal Project* and will be reviewed with all project personnel. A project phone list is presented in Appendix A.

3.0 SITE INFORMATION

3.1 ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE (RFETS)

3.1.1 RFETS Location

RFETS is located in northern Jefferson County, Colorado, approximately 16 miles northwest of Denver. The cities of Boulder, Broomfield, Westminster, and Arvada are located less than 10 miles to the north, northeast, east, and southeast, respectively. RFETS consists of approximately 6,550 acres and occupies Sections 1 through 4 and 9 through 15 of Township 2 South, Range 70 West, 6th Principal Meridian. Major plant buildings are located within an RFETS security area of approximately 400 acres. The security area is surrounded by a buffer zone of approximately 6,150 acres. RFETS is generally bounded on the north by State Highway 128. To the east is Jefferson County Highway 17, also known as Indiana Street; to the south are agricultural and industrial properties, and State Highway 72; and to the west is State Highway 93. A RFETS location map is shown in Figure 3.1.

3.1.2 RFETS Background

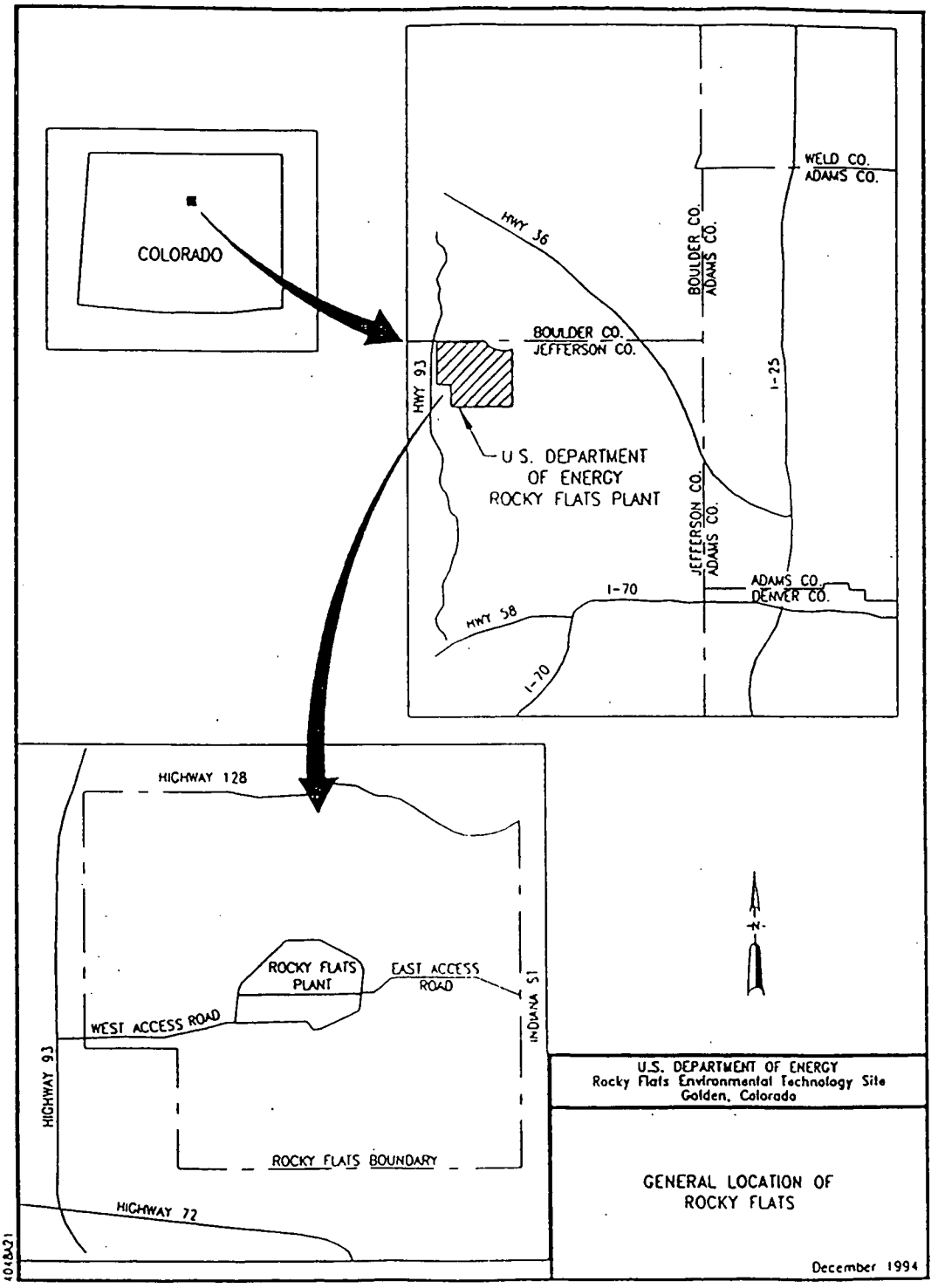
RFETS is a government-owned and contractor-operated facility that is part of the nationwide nuclear weapons production complex. It was operated for the U. S. Atomic Energy Commission (AEC) from RFETS's inception in 1951, then known as the Rocky Flats Plant, until the AEC was dissolved in January 1975. Then, responsibility for Rocky Flats Plant was assigned to the Energy Research and Development Administration (ERDA), which was succeeded by the Department of Energy (DOE) in 1977. Dow Chemical USA, an operating unit of the Dow Chemical Company, was the managing and operating contractor of the facility from 1951 until June 30, 1975. Rockwell International succeeded Dow Chemical USA from July 1, 1975 to January 1, 1990. EG&G Rocky Flats, Inc. succeeded Rockwell International and operated the plant from January 1, 1990 to July 1, 1995. The plant name was changed to Rocky Flats Environmental Technologies Site in 1994. The plant has been operated by Kaiser-Hill Company Incorporated since July 1, 1995.

3.1.3 RFETS Operations

Prior to 1992, production activities included fabrication of nuclear weapons components from beryllium, plutonium, stainless steel, and uranium; assembly of components; and chemical recovery and purification of recyclable transuranic radionuclides. Nuclear weapons parts produced at RFP were shipped off-site for assembly. Obsolete weapons parts fabricated at RFP were returned for plutonium recovery processing. Other activities included research and development in metallurgy, machining, nondestructive testing, coatings, remote engineering, chemistry, and physics. The major classes of waste generated includes hazardous waste, radioactive waste, and mixed (hazardous and radioactive) waste. Currently, the mission

at RFETS is decontaminating, decommissioning, and environmental restoration of the plant.

Figure 3.1
RFETS Site Location Map



3.2 TRENCH 1 SITE (IHSS 108)

3.2.1 Trench 1 Site Location

Trench 1 is located in the Buffer Zone Operable Unit just northwest of the inner east gate, and about 40 feet south of the southeast corner of the Protected Area (PA) fence. The trench is approximately 250 feet long, 16 to 25 feet wide, and 10 feet deep. Maps of the site are illustrated in Figures 3.2, 3.3, and 3.4.

3.2.2 Trench 1 Site Background

Drums of depleted uranium waste from Building 444 were first placed in Trench 1 in November 1954 and burial continued intermittently until December 1962. Wastes were initially buried in Trench 1 when Building 444 could not safely process drums of depleted uranium chips and turnings. In addition to the depleted uranium, the drums also contained lathe coolant, dirt, and other foreign material. Historical information indicates other waste are buried in T-1 from Building 444 including ten drums of cemented cyanide, one drum of still bottoms and copper alloy. The east end of the trench is expected to contain crushed drums, broken pallets, debris, and trash.

Depleted uranium casting and machining operations began in Building 444 in 1953. The production operations were conducted to support war reserve, special order, and manufacturing development work. Weapons components were fabricated from various materials including depleted uranium, beryllium, stainless steel, and aluminum. Operations in Building 444 included casting, fabrication, assembly, inspection and testing, coating and heat treating, plating, and special projects and support operations. Machining operations included turning, facing, boring, milling, and sawing of the above materials using lathes, saws, milling equipment and other conventional machine tools. In 1956, the chip roaster began operation in Building 447 to roast depleted uranium chips from the machining processes conducted in Building 444. The "roasting process" converted the depleted uranium metal to a chemically stable U_3O_8 configuration. The roaster was out of service from 1959 to 1961. The waste depleted uranium chips in lathe coolant, and floor sweepings were stored on the Building 444 dock before the roaster became operational and during the roaster shutdown period. It was during the periods prior to the roaster becoming operational and when the roaster was shutdown that wastes from Building 444 were buried in Trench 1.

Historical records and information obtained through employee interviews indicate that 125, 30-gallon and 55-gallon steel drums containing 10,000-20,000 kilograms of depleted uranium chips and turnings, and miscellaneous debris were disposed of in Trench 1. Drum inventory lists, memoranda, and drum shipping logs documenting the placement of 85 drums in Trench 1 have been located. The uranium chips and turnings were coated with a water-soluble lathe coolant (trade name Cimcool®) during machining of parts. Several of the drums containing depleted uranium and lathe coolant oil are described in historical

documents as 30-gallon drums placed inside 55-gallon drums and then overpacked with graphite. The graphite is believed to have been excess material derived from waste graphite molds utilized during production operations in Building 444.

Personnel directly involved in the trench disposal activities stated that the buried 30 and 55-gallon drums were generally double-stacked in the trench on end (vertically), in rows of 4 to 5 drums across. The bulk of the drums containing depleted uranium were reportedly disposed in the west portion of the trench from 1954 to 1962. Individual groups of drums were reportedly completely covered with one to two feet of soil immediately after placement in the west end of the trench. Miscellaneous debris was placed mostly in the central and eastern portions of the trench until the trench was closed in 1962.

Weed cutting activities in October and November, 1982 unearthed two drums not adequately covered with fill material. Both drums were sampled and the liquids were transferred to Waste Processing for disposal. One drum is documented to have contained an oil/water mixture which yielded plutonium analyses of 55 picocuries per liter (pCi/l) and uranium analysis of 2.3 X 10^5 pCi/l. The other drum is documented as containing an oily sludge which yielded results of 4.3 picocuries per gram (pCi/g) plutonium and 1.2E10^6 pCi/g uranium.

In addition to the drums containing depleted uranium, the inventory records also include ten drums of cemented cyanide waste from Building 444. Cyanide and cadmium wastes are also known to have been generated during metallurgical operations in Building 444.

Still bottom wastes may have originated from a pilot-scale 55-gallon drum evaporator reportedly used in Building 444 for reducing machine coolant oil waste volume. The resulting condensate was transferred to the process waste treatment system in Building 774, and the still bottoms were drummed and buried through normal disposal channels. Still bottoms from Building 444 could potentially consist of either the lathe coolant sludge or still bottoms from the recovery of residual trichloroethylene and perchloroethylene waste solvents generated from machined parts cleaning.

3.2.3 Trench 1 Operations

In order to work during inclement weather , a temporary stressed membrane tent structure will be erected over Trench 1. The temporary structure will be "L" shaped with the long east-west leg encompassing the trench and providing a work area for the treatment subcontractor. The north leg will be utilized for the stockpiling of soil which may be backfilled into the trench after excavation. The structure is 70 feet wide and 32 feet tall at the peak and is equipped with two double panel rolling doors, two side-sliding doors, nine single personnel doors, and two double personnel doors. Ventilation of the structure will be accomplished through the use of twelve 4,185 cfm roof mounted explosion proof electric fans.

RMRS operations within the stressed membrane tent structure will include the excavation, segregation, sampling/characterization, and packaging of non-depleted uranium-containing waste such as soil, debris, unknown material, and suspected classified items removed from the trench. In addition, soil characterized as radiologically non-contaminated will be transported and stockpiled by RMRS within the tent structure.

A Sampling and Inerting Pad (SIP) will be setup in the west end of the temporary structure to provide a work area in close proximity to the excavation. SIP operations will be conducted by the Starmet Corporation of Concord, Massachusetts. The Starmet team is comprised of personnel who work for Scientech, Incorporated and the S.M. Stoller Corporation. Operations within the SIP include managing, segregating, sampling/characterizing, inerting/stabilizing, and packaging depleted uranium-containing drums and soils, drums containing unknown liquids and solids, and other waste materials. The SIP will include a secondary containment for spill control during the packaging of liquid wastes.

Operations outside of the tent structure will include the storage and management of waste containers and support activities such as maintaining the breathing air system and operation of pumps for dust suppression. The three project field trailers will be used for administrative, health and safety, and radiological operations functions.

4.0 SCOPE OF WORK

The scope of work will involve excavating the drums of depleted uranium chips, cemented cyanide, and still bottoms, soil, and miscellaneous debris including pallets, empty drum carcasses and trash. The potential exists for unidentifiable material and suspected classified items to be encountered. Upon excavation from the trench, drums, debris, unidentifiable material, and suspected classified items will be segregated and packaged according to identifiable waste types and the results of initial field characterization for radiological characteristics and chemical contamination. Excavated soil will either be stockpiled in the north leg of the temporary structure pending further evaluation or packaged for treatment or offsite disposal.

Prior to being sealed, waste packages will be sampled to support the final disposition or treatment of materials. They will then be sealed, appropriately labeled, radiologically surveyed, and transported out of the temporary structure for storage and management in the Waste Container Staging Area pending shipment to an offsite disposal or treatment facility. Waste packages prepared by the treatment subcontractor which contain depleted uranium will be dealt with in the same manner except that they will be inerted prior to being sealed.

Excavation will continue until excavation verification sampling indicates that material and soils equal to or above the cleanup target levels described in the PAM have been removed or the limiting conditions in the PAM have been encountered. At the end of the excavation phase of the project, the soil stockpile located in the temporary structure will be sampled for both radiological and VOC content to determine if treatment for VOCs is necessary and if radiological content allows for backfilling into Trench 1. If radiological contamination levels in the soil allow for backfilling into the trench and treatment for VOCs is necessary and cost effective, low temperature thermal desorption technology will be used to remove the VOCs from soils. If radiological conditions do not allow for backfilling or if treatment for VOCs is not cost effective, the soil will be shipped offsite for disposal.

After excavation and soil stockpile characterization sampling is completed, soil which is not radiologically or VOC contaminated above the cleanup target levels will be placed back in the excavation. If soil is treated with low temperature thermal desorption technology, it will be backfilled into the excavation upon confirmed attainment of cleanup target levels. Additional material will be imported to backfill the excavation as necessary. The site will then be demobilized and reclamation will be performed to return it to improved natural conditions.

The following is a detailed breakdown of the tasks to be implemented during the source removal at Trench 1. Task specific Activity Hazard Analyses are included in Appendix B. Note: Should additional tasks with activities and hazards similar to those addressed in this HASP arise during the course of the project, a task specific Activity Hazard Analysis will be developed and incorporated into Appendix B.

The following is a list of general activities required to accomplish the tasks within the temporary structure. Activities which are specific to a given task will be addressed within each task section listed below.

- working under the stipulations of a Radiological Work Permit (RWP);
- wearing appropriate personal protective equipment;
- performing high volume and low volume radiological air sampling as stipulated in the ALARA Job Review;
- performing contamination surveys on drums, debris, and equipment;
- performing FIDLER surveys on soil;
- maintaining and operating Continuous Air Monitors (CAMs);
- performing radiation surveys as required;
- monitoring personnel for radiological contamination;
- conducting real-time air monitoring for VOCs, combustible gases, particulates, and diesel combustion byproducts;
- conducting personal and area integrated air sampling for chemicals of concern;
- monitoring personnel for noise and heat/cold stress exposure;
- spraying water to minimize dust;
- decontaminating equipment;
- managing waste such as disposable personal protective equipment; and
- securing the site at the end of each day.

4.1 TASK 1 - EXCAVATION OF DRUMS, SOIL, DEBRIS, UNKNOWN MATERIAL, AND SUSPECTED CLASSIFIED ITEMS

This task includes excavating approximately 1,500 to 1,800 cubic yards of material including drums of depleted uranium, cemented cyanide, and still bottoms, soil, miscellaneous debris including pallets and trash, unknown materials, and suspected classified items. The trench contents will be excavated with a track-mounted excavator, and if needed a backhoe and/or front-end loader. It is expected that the excavator operator will advance the excavation of the trench from west to east, with the excavator positioned on top of the un-excavated portion of the trench. To prevent buildup of diesel exhaust in the temporary structure, the excavator will be equipped with an exhaust pipe extension which will direct the exhaust toward the roof mounted fans. If diesel exhaust emissions cannot be maintained below levels that are Immediately Dangerous to Life and Health (IDLH), the excavator exhaust may be vented outside of the structure via a flexible tube. Dust suppression will be performed to limit the generation of airborne dust during excavation activities. A spotter will assist the excavator operator in positioning the excavator over the trench, locating the excavator bucket inside the excavation, watching for unanticipated hazards or conditions, and transferring the excavated material into containers. All ground personnel communications with the excavator operator will go through the spotter who will communicate with the operator using a hand-held radio and/or hand signals.

Material removed from the trench will be visually inspected and initially characterized adjacent to the trench to ensure safe handling and to provide information for segregation and packaging (See Section 4.2). The initial characterization for individual waste types is summarized in Table 4.1.

Table 4.1
Initial Characterization Summary

Waste Type	Initial Characterization Type/Instrument[1,2,3,4]
Drums (intact)	• Heat testing - Newport Model OS521 Handheld Infrared Thermometer • Radiation Survey - Eberline Model RO-20 Beta/Gamma Radiation Detector • Combustible gases - Mine Safety Appliances Model Passport • VOCs - Foxboro Model TVA 1000 PID/FID • Radiological contamination survey of accessible surfaces - NE Technology Model Electra or Ludlum Model 31 with 44-9 Probe and Ludlum Model 12-1A • pH of any liquids present
Drums (non-intact)	• Heat testing - Newport Model OS521 Handheld Infrared Thermometer • Radiation Survey - Eberline Model RO-20 Beta/Gamma Radiation Detector • Combustible gases if voids are present - Mine Safety Appliances Model Passport • VOCs - Foxboro Model TVA 1000 PID/FID • Radiological contamination survey of accessible surfaces - NE Technology Model Electra or Ludlum Model 31 with 44-9 Probe and Ludlum Model 12-1A • pH of any liquids present
Soil	• Low Energy Gamma Radiation Screening - Bicron FIDLER • VOCs - Foxboro Model TVA 1000 PID/FID
Debris	• Radiation Survey - Eberline Model RO-20 Beta/Gamma Radiation Detector • Combustible gases if voids are present - Mine Safety Appliances Model Passport • VOCs - Foxboro Model TVA 1000 PID/FID • Representative radiological contamination survey of accessible surfaces - NE Technology Model Electra or Ludlum Model 31 with 44-9 Probe and Ludlum Model 12-1A
Unknown Material or Containers and Suspected Classified Items	• Heat testing - Newport Model OS521 Handheld Infrared Thermometer • Radiation Survey - Eberline Model RO-20 Beta/Gamma Radiation Detector • Combustible gases if voids are present - Mine Safety Appliances Model Passport • VOCs - Foxboro Model TVA 1000 PID/FID • Radiological contamination survey of accessible surfaces - NE Technology Model Electra or Ludlum Model 31 with 44-9 Probe and Ludlum Model 12-1A • pH of any liquids present

[1] Instruments are those anticipated to be used. Equivalent instruments may be substituted after approval from Radiologcal Engineering or Industrial Hygiene.
[2] Initial characterization will be performed in the order shown.
[3] Action levels for individual instrument readings and the action to be taken can be found in Table 7.2.
[4] pH levels are discussed in Section 4.4.2.

Task specific activities required to accomplish the excavation of drums, soil, debris, unknown material, and suspected classified items include the following:

- positioning a full-time spotter to aid the operator and watch for unanticipated hazards or conditions;
- venting the excavator exhaust outside of the temporary enclosure, if necessary;
- inspecting and operating the excavator;
- venting drums while in the excavation;
- working around an open excavation;
- maintaining a high level of housekeeping and cleaning up any uncontained soil and/or debris outside of the trench during excavation;
- spraying water when excavating to minimize airborne dust, as necessary.
- using a heat gun to detect drums and/or material with elevated temperatures;
- pumping groundwater from the excavation;
- placing excavated material in containers or front-end loader bucket; and
- moving soil with a front-end loader.

4.1.1 Excavation of Drums

All drums encountered in the trench will be handled as though they contain depleted uranium and removed from the trench individually in order to minimize potential exposure to workers, the environment, and the public. The drums will be exposed one row at a time, so that the maximum number of drums exposed at any one time will be twelve, assuming the drums are stacked two high in rows of six drums across (as indicated by information obtained from former Rocky Flats employees associated with burial of wastes in Trench 1). To limit the amount of depleted uranium that can be exposed and potentially involved in a fire or spill, control limits have been developed and are as follows:

- twelve drums, or drum equivalents if drums are not intact, may be exposed at one time in the trench and immediately adjacent to the trench in the segregation/packaging area.
- six drums, or drum equivalents if drums are not intact, may be exposed at the Sampling and Inerting Pad at one time.

A detailed evaluation of the above control limits is provided in the *Safety Analysis for Individual Hazardous Substance Site (IHSS) 108 Trench 1 Source Removal Project*.

Prior to removal from the trench, the drums will be vented to release any potentially explosive hydrogen gas build-up inside the drum. Venting of the drums will be accomplished with a piercing device mounted to the excavator bucket. The device used to vent the drums shall be made of a non-sparking material to minimize spark-potential and will be designed to ensure that both drums, if drums are overpacked, are

pierced. Venting will be performed inside the trench prior to removal of the drum from the trench. During the venting of the drums, all personnel in the immediate excavation work area will relocate to predetermined locations away from the trench.

After each intact drum has been vented, individual drums will be carefully removed from the excavation using the excavator bucket, and placed into a shallow steel containment pan for initial characterization as shown in Table 4.1. If the initial characterization indicates that the drum can be safely handled, the drum will be placed in a overpack drum or other container and transported to the SIP for further evaluation of the drum contents.

If a drum is not intact, the drum and/or drum fragments and approximately one cubic yard of surrounding soil and material will be removed from the trench and placed directly into a steel waste package. The material will undergo the same initial characterization as for intact drums and segregated as indicated in Section 4.2.1.

4.1.2 Excavation of Soil

Excavated soil will be raised in the excavator bucket and the bucket will be placed on the ground. Soil in the bucket will be initially characterized as shown in Table 4.1 and segregated based on the characterization results (See Section 4.2.2).

4.1.3 Excavation of Debris

Miscellaneous debris and trash excavated from the trench is expected to include compatible materials such as waste personal protective equipment, wood, metal, rubber, plastics, paper, and glass. Immediately following removal from the trench and while still in the excavator bucket, these items will be visually inspected for stains or discolorations and initially characterized as shown in Table 4.1.

4.1.4 Excavation of Unknown Materials

It is important to note that unknown materials do not necessarily constitute an Unanticipated Hazard or Condition. If, however, unknown material are discovered, they will be evaluated in accordance with RMRS Directive-001 as presented in Section 7.7.

Materials or containers with liquids and/or sludge which cannot be immediately identified will be inspected for labels, markings, or other information and initially characterized as shown in Table 4.1. If it can be done safely based on the initial characterization and the RMRS Directive-001 evaluation, the material or container will then be appropriately packaged and transferred to the SIP for further evaluation.

4.1.5 Excavation of Suspected Classified Items

Items suspected of being "classified" will be initially characterized per Table 4.1. They will then be isolated and the RFETS Classification Office will be contacted to determine if the item is classified. If classified, the item will be secured and the final disposition will be determined by the Classification Office.

4.2 TASK 2 - SEGREGATION AND PACKAGING OF DRUMS, SOIL, DEBRIS, UNKNOWN MATERIAL, AND SUSPECTED CLASSIFIED ITEMS

Drums, soil, debris, unidentifiable material, and suspected classified items will be segregated and packaged according to identifiable waste types and the results of initial field characterization. To the extent possible, all material will be segregated and packaged adjacent to the trench using the excavator bucket. If manual handling of material is necessary, remote handling devices will be used when feasible. Waste packaging will be conducted in accordance with Operations Order No. 00-T1-07 *Packaging of Trench T-1 Waste.*

4.2.1 Segregation and Packaging of Drums

Intact drums containing depleted uranium, still bottoms, cemented cyanide, or unknown material will be removed from the trench, initially characterized, and if they have sufficient structural integrity for hoisting, placed in an overpack drum. If the intact drums do not have sufficient structural integrity, they will be placed in an approved waste package. Hoisting of intact drums into overpack drums will be done with a hoisting apparatus designed for placing 55-gallon drums into overpacks. A Lifting Plan (Appendix D) has been developed for the overpacking of intact drums and a hoisting and rigging checklist will be completed per HSP- 12.02, *Hoisting and Rigging*. The waste package will then be transferred to the SIP where the contents will be further characterized, sampled, and segregated by SIP personnel. Drums containing depleted uranium chips will be stabilized by inerting with mineral oil, appropriately packaged for offsite shipment, and transferred to the Waste Container Staging Area located outside of the temporary structure. Cemented cyanide and still bottom wastes will be sampled, appropriately packaged, and staged in the Waste Container Staging Area. Upon receipt of analytical results, cemented cyanide and still bottom wastes will be managed for appropriate treatment and/or disposal.

Non-intact drums and associated soil will be removed from the trench and segregated based on the initial characterization. The initial characterization will be conducted while the material is still in the excavator bucket so that depleted uranium and non-depleted uranium-containing waste streams are not placed in the same waste package.

As the packages containing depleted uranium material are being filled, personnel may remove drum fragments and rake the soil to minimize voids. Drum fragments will be surveyed and placed in a separate waste container designated for debris. Packages containing or suspected of containing depleted uranium

will be transferred to the SIP where they will be sampled, stabilized by inerting with soil, packaged for offsite shipment, and transferred to the Waste Container Staging Area located outside of the temporary structure.

4.2.2 Segregation and Packaging of Soil

Depending on the results of the initial characterization as depicted in Table 4.1, soil will be segregated and placed directly into waste packages or transferred to the soil stockpile. With the exception of the soil transferred to the soil stockpile, all soil will be packaged adjacent to the trench. The soil segregation methodology is summarized below in Table 4.2.

Table 4.2
Soil Segregation Methodology

FIDLER Readings (cpm)[1]	VOC Readings (ppm)[2]	Contains DU Chips and Turnings	Action
NA	NA	Yes, or suspected to contain	Package and transfer to the SIP.
< 5,000 cpm	< 25 ppm	No	Transfer to the soil stockpile.
NA	≥25 ppm	No	Package as mixed/low-level waste.
≥5,000, ≤10,000 cpm	< 25 ppm	No	Package or transfer to the soil stockpile. Segregate from < 5,000 cpm at soil stockpile.
> 10,000 cpm	< 25 ppm	No	Packaged as low-level waste.
NA	< 25 ppm	No, but contains oxides of DU	Packaged as low-level waste.

[1] cpm - Counts per minute
[2] ppm - Parts per million above background

4.2.3 Segregation and Packaging of Debris

Miscellaneous debris and trash excavated from the trench may include materials such as spent personal protective equipment, wood, metal, rubber, plastic, paper, and glass. Materials removed from the trench will be visually inspected for stains or discolorations indicating potential contamination and initially characterized per Table 4.1. Debris will be segregated and packaged adjacent to the excavation based on like waste forms and the results of the initial characterization. If the initial characterization of the debris

indicates the presence of VOC's or it is suspected to be chemically contaminated based on visual inspection, it will be placed in a waste container designated for mixed/low-level waste. If chemical contamination is not detected or suspected, the debris will be handled as low-level waste and packaged accordingly.

To optimize the volume of a steel waste package, size reduction of debris may be required. Size reduction will be conducted only after the initial characterization and identification of all potential hazards (See Table 4.1) as follows:

- Common debris such as wood, metal, rubber, plastic, and glass may be reduced with the excavator bucket either in the trench or as it is placed into the steel waste package.
- Empty drum carcasses which do not contain liquids or depleted uranium chips or oxide, may be reduced with the excavator bucket in the trench.
- Drums or drum fragments which previously contained liquids and do not contain depleted uranium chips or oxide, may be reduced with the excavator bucket in the trench.

Note: Drums containing or suspected of containing depleted uranium chips or oxide will not be sized reduced.

4.2.4 Segregation and Packaging of Unknown Material

All materials that cannot be immediately identified will be initially characterized as shown in Table 4.1 and, if safe to do so, will be transferred to the SIP for further analysis, sampling, stabilization if necessary, and packaging.

Containers of unknown liquids or sludges will be inspected for labels, markings, or other identifying information, and repackaged to ensure container contents remain controlled during transport to the SIP.

4.2.5 Segregation and Packaging of Suspected Classified Items

Items suspected of being "classified" will be segregated and packaged depending on the results of the initial characterization. The RFETS Classification Office will be contacted to determine if the item is classified and to remove it if necessary.

4.3 TASK 3 - TRANSPORTING MATERIAL TO THE SAMPLING AND INERTING PAD (SIP)

Transport of drums, soils containing uranium chips, or unknown materials to the SIP will be done using a overpack drum or sealable steel container and a forklift. Breathing air cylinders will be mounted on the forklift to allow the operator to wear an airline respirator for extended periods of time. To expedite the

excavation process, several overpack drums and steel transfer containers will be positioned near or adjacent to the trench where they may be filled, sealed and transported to the SIP. The forklift will travel on established roadways within the temporary structure. Dust suppression on the roadways will be performed to limit the generation of airborne dust.

Task specific activities required to accomplish the transporting of waste packages to the SIP include the following:

- inspecting and operating the forklift;
- establishing roadways to ensure the safe movement of the forklift; and
- spraying water on the roadways to minimize dust, as necessary.

4.4 TASK 4 - SAMPLING AND INERTING PAD (SIP) OPERATIONS

4.4.1 Characterization of Material Received at the SIP

Materials that may be received at the SIP include depleted uranium, depleted uranium-containing drums and soils, drums containing unknown liquids and solids, and other waste materials. Initial screening of materials will have been performed upon removal of material from the trench and the results will be communicated to SIP personnel via the waste package specific Checklist for Packaging Trench 1 Waste contained in Operations Order No. 00-T1-07, *Packaging of Trench T-1 Waste*. The initial field screening information will be used to determine the sampling, inerting, and packaging methods that will be applied to the materials at the SIP. If necessary, additional measurements will be taken using direct-reading instruments to provide additional information to SIP personnel. It is anticipated that most materials will be identified by the time they reach the SIP. It is also anticipated that most materials will have been placed into containers which meet DOT requirements for shipping. The materials will be sampled, inerted if appropriate, and the containers will be sealed, labeled, and transported out of the temporary structure to the Waste Container Staging Area pending disposition.

Task specific activities required to characterize materials received at the SIP include:

- review of initial screening data conducted as material is removed from the trench;
- visual inspection of materials received; and
- obtaining additional screening measurements as necessary.

4.4.2 Sampling and Inerting Depleted Uranium Chips and Intact Drums

This task involves visual inspection of the drum to determine if free liquids, Cimcool®, and depleted uranium chips are present. Depending on the condition of the drum or drums, and the ability of SIP

personnel to access the contents, the lid may be removed. If there are liquids in the drum, SIP personnel may first obtain a sample of the liquids for characterization in accordance with the Starmet *Sampling and Analysis Plan (SAP)*. Easily accessible liquids will then be pumped out of the drum into an appropriate package and bulk sampling may be conducted. Although most of the liquids in the drums are anticipated to be Cimcool® and will be packaged together, the following precautions will be taken to determine compatibility of liquids before being mixed together:

- pH - pH will have been determined during initial field screening and communicated to SIP personnel. In general, liquids with a pH of 5 to 9 may be mixed together. If necessary, separate containers will be established for liquids exhibiting pH <5 and >9;
- VOCs - liquids which exhibit high VOC readings should not be mixed with liquids exhibiting low VOC readings. Although VOC content is not necessarily a compatibility issue, this is a good waste management practice; and
- appearance - SIP personnel shall evaluate compatibility based on appearance including such characteristics as color, and viscosity. Liquids which differs greatly from what is already in the receiving package should be further evaluated to ensure compatibility.

Once the liquids have been removed from the drum, a sample of the drum contents will be taken either before or after inerting and any turnings that are visible may be compressed with a long-handled non-sparking tool. Prior to inerting, temperature measurements of the depleted uranium will be obtained to verify that it is not undergoing rapid thermal oxidation that could ignite the mineral oil during inerting. If the temperature measurements indicate that the depleted uranium is not undergoing a thermal reaction, mineral oil will then be added to the waste package as necessary to cover the drum contents and meet DOT requirements for inerting. The overpack drum will then be sealed with a vented lid, appropriately labeled, and staged for transport from the SIP to the east end of the temporary structure.

Task specific activities required to sample and inert intact drums containing depleted uranium include:

- visual inspection of the container to identify depleted uranium chips and Cimcool® or other liquids;
- removing lids if necessary;
- weighing the waste package;
- obtaining liquid and solid samples per the Starmet SAP;
- removal and packaging of Cimcool® or other liquids;
- compression of depleted uranium using long-handled non-sparking tool;
- obtaining depleted uranium temperature measurements just prior to inerting;
- inerting of depleted uranium with mineral oil; and
- container sealing and labeling.

4.4.3 Sampling and Inerting Materials in Non-Intact Drums

This task involves visual inspection of the container to determine if depleted uranium chips are visible, as well as determining if any free liquids remain in the damaged drum which will be in an a box-type waste package when it reaches the SIP. If Cimcool® or other liquids are present and covering the depleted uranium, sampling may be performed in accordance with the SAP. The liquids will then be pumped off and packaged based on the compatibility determination discussed above. Once any liquids have been removed, a sample of the solids will be taken either before or after inerting with clean soil (not containing depleted uranium). The box-type container will then be sealed with a vented lid, labeled appropriately, and staged for transport from the SIP to the east end of the temporary structure.

Task-specific activities required to sample and inert non-intact drums include:

- visual inspection of the package to identify depleted uranium chips and Cimcool® or other liquids;
- weighing the waste package;
- obtaining liquid and solid samples per the SAP;
- removal and packaging of Cimcool® or other liquids;
- compression of depleted uranium using long-handled non-sparking tool;
- inerting of depleted uranium with soil; and
- container sealing and labeling.

4.4.4 Sampling and Inerting Commingled Soils/Materials

This task involves inspection of the container to determine if depleted uranium chips are visible. Large pieces of drums, pallets, and other solid wastes that are not contaminated with depleted uranium may be removed from the container and segregated for appropriate disposal. A sample of the container contents will then be obtained in accordance with the SAP. If depleted uranium chips are present or suspected to be in the container, additional clean soil (not containing depleted uranium) will be added to the surface to inert the container. The vented container will then be sealed, labeled, and staged for transport from the SIP to the east end of the temporary structure.

Task specific activities required to sample and inert commingled soil/materials include:

- Visual inspection of the container to identify depleted uranium chips;
- visual identification and removal of bulky waste items as appropriate;
- weighing the waste package;
- obtaining samples per the SAP;
- inerting containers with clean soil; and

- container sealing and labeling.

4.4.5 Sampling Cemented Cyanide and/or Still Bottom Wastes

Drums containing these materials will be initially screened and packaged upon removal from the trench and transported to the SIP. SIP personnel will manage any liquids present, collect samples per the SAP, seal and label the container, and stage the container for transport from the SIP to the east end of the temporary structure.

Task specific activities required to sample cemented cyanide and/or still bottoms include:

- visual inspection of the container to verify contents;
- obtaining samples per the SAP; and
- container sealing and labeling.

4.5 TASK 5 - TRANSPORT OF SOIL TO THE SOIL STOCKPILE

This task involves the use of a front-end loader to transport soil from the excavation to the soil stockpile. The soil stockpile is located in the north leg of the temporary structure. To ensure safe movement of the front-end loader to the soil stockpile, roadways will be established. The front-end loader will dump loads of soil at the soil stockpile in a manner which limits the generation of dust. If necessary, dust suppression with clean water will be performed to limit the generation of airborne dust.

Activities required to accomplish the transport, dumping, and stockpiling of soil include the following:

- inspecting and operating the front-end loader;
- sampling soils with 5,000-10,000 cpm readings on the FIDLER from the front-end loader bucket;
- establishing a roadway to ensure the safe movement of the front-end loader; and
- spraying water when loading, prior to transport, on the roadway, and when dumping to minimize dust;

4. 6 TASK 6 - MANAGEMENT OF THE SOIL STOCKPILE

This task involves the management of the stockpiled soil within the temporary structure. To facilitate efficient stockpiling of soil, a front-end loader will be utilized due to its versatile ability to stockpile soil. Management of the soil stockpile also includes ongoing dust suppression with clean water as required.

Activities required to accomplish the loading and management of the soil stockpile include the following:

- operating the front-end loader;
- spraying water for dust suppression as required; and
- sampling the soil stockpile at the completion of excavation activities.

4.7 TASK 7 - MANAGEMENT OF WASTE CONTAINER STAGING AREA

Several different waste streams will be generated during this project. With the exception of the soil in the soil stockpile, all waste will be appropriately packaged for treatment or disposal. The waste streams identified may include the following:

- stabilized depleted uranium chips and depleted uranium-containing soil;
- liquid waste such as still bottoms or Cimcool®;
- contaminated soil;
- debris including drum carcasses, wood, paper, filters;
- used PPE;
- decontamination waste water and remediation waste waters;
- miscellaneous hazardous waste such as cemented cyanide; and
- sanitary waste.

After waste packages originating from either the SIP or outside of the SIP have been sealed and labeled, they will be transported via forklift to the east end of the temporary structure where they will be radiologically surveyed for unrestricted release. To ensure that the storage areas outside of the temporary structure are posted correctly in regards to radiation levels, radiation surveys will be conducted on the waste packages prior to or immediately after exiting the temporary structure. Once outside of the temporary structure, containers will be staged according to their contents. Specific waste container staging areas are summarized in Table 4.3.

Table 4.3
Waste Container Staging Area Summary

Waste Type	Staging Area Type
Low-level waste	Radioactive Material Area (RMA)
Mixed/Low-level waste	Temporary Unit with RMA Posting
RCRA hazardous waste	Temporary Unit

Task specific activities required to manage the Waste Container Staging Area include the following:

- conducting formal documented inspections of staging areas at proper intervals;
- inspecting and operating forklifts;
- placing 83 gallon overpack drums into 110 gallon overpack drums in accordance with the Lifting Plan located in Appendix D;
- establishing roadways for forklift operations; and
- loading waste containers onto transports.

4.8 TASK 8 - EXCAVATION VERIFICATION SAMPLING

At the completion of excavation operations per the PAM, verification soil samples will be collected along the base and sides of the excavation to determine the post-action condition of the subsurface soils. Verification samples will be collected and analyzed according to the procedures and requirements stated in the *Sampling and Analysis Plan to Support the Source Removal at Trench T-1 Site, IHSS 108* (SAP). The sampling will be performed after a nominal six-inch scrape below the drums and debris to clear the trench bottom of any residual waste material. Visible staining which may extend beneath the trench bottom will also be removed prior to collecting samples. If sample analytical results indicate that contamination is present above cleanup target levels, further excavation and sampling will continue until cleanup target levels are achieved, or one of the limiting conditions discussed below are met.

If contamination is encountered below the bottom of the trench, the excavation will be limited to the highly weathered bedrock, one to three feet below the alluvial/bedrock contact, or to the depth of groundwater, if encountered. Unweathered bedrock will not be excavated. A FID and/or PID as well as a FIDLER will be used as field screening tools to guide the excavation activities before collection of the excavation verification samples.

Activities required to accomplish this sampling include the following:

- inspecting and operating the excavator;
- decontaminating the excavator bucket;
- sampling from the excavator bucket;
- decontaminating sampling equipment; and
- packaging the samples for shipment.

4.9 TASK 9 - SOIL TREATMENT

If substantial quantities of soil are found to be contaminated with VOCs, treatment may be necessary. Low vacuum low temperature thermal desorption or other equally effective technology may be used to treat the soil. If treatment is required, a separate health and safety plan will be developed by the subcontractor.

4.10 TASK 10 - SURVEY/DEPOST TEMPORARY STRUCTURE

At the completion of excavation activities, tent, equipment, and soil surveys will be conducted to evaluate the possibility of downgrading or deposting the High Contamination Area and Contamination Areas.

Activities required to accomplish this surveying include the following:

- operating an aerial lift to access above ground areas of the tent;
- using ladders and/or fall arrest equipment to access above ground areas of heavy equipment; and
- using fall arrest equipment when conducting FIDLER surveys within six feet of the excavation.

4. 11 TASK 11 - SOIL TRANSPORT AND BACKFILL

This task involves the use of a front-end loader to transport soil from the soil stockpile back to the excavation. To ensure safe movement of the front-end loader, a roadway will be established. The front-end loader will dump loads of soil at the excavation in a manner which limits the generation of dust. If necessary, dust suppression with clean water will be performed to limit the generation of airborne dust.

Activities required to accomplish the transport, dumping, backfilling, and compaction and of soil include the following:

- operating the front-end loader;
- instituting appropriate radiological controls based on soil stockpile sampling results and the radiological conditions at the site;
- establishing roadways to ensure the safe movement of the front-end loader; and
- spraying water when loading, prior to transport, on the roadways, and when dumping to minimize dust.

4.12 TASK 12 - SITE RECLAMATION

At the completion of the project topsoil will be returned the site. The topsoil will be graded and the site will be revegetated with an appropriate seed mixture in order to return it to an improved natural condition. The seed mixture will be covered to prevent wind dispersal and promote germination.

Activities required to accomplish site reclamation include the following:

- operating heavy equipment on established roadways;

- instituting radiological controls depending on soil stockpile sampling results and the radiological conditions at the site;
- monitoring wind speed;
- applying ConCover as necessary;
- performing FIDLER surveys of the soil stockpile and excavation areas; and
- securing the site at the end of each day.

4.13 TASK 13 - DECONTAMINATION OF EQUIPMENT

Materials and equipment may require decontamination prior to release from the temporary structure and prior to unrestricted free release from RFETS to off site locations. Decontamination methods will vary depending on the location and extent of contamination and effectiveness will be determined by visual inspection, radiological monitoring, and volatile organic compound monitoring. At the discretion of the project manager, items may be decontaminated in the field or transferred to the Main Decontamination Facility.

Activities required to decontaminate heavy equipment and materials include the following:

- staging heavy equipment;
- establishing a portable decontamination station with secondary containment;
- transferring items to the Main Decontamination Facility;
- spraying water at low or high pressures and/or wiping or scrubbing; and
- managing decontamination waste such as decontamination fluids.

5.0 HAZARD ASSESSMENT

The Trench 1 area was investigated during the 1995 Operable Unit 2 Resource Conservation and Recovery Act (RCRA) Facility Investigation/Remedial Investigation (RF/RI) Program. Additional characterization was conducted as part of the 1995 Trenches and Mound Site investigation. Due to the suspected presence of pyrophoric uranium and its associated hazards, no drilling or subsurface sampling has been performed inside the Trench 1 boundaries. Historical data were compiled using the Historical Release Report and supplemented with employee interviews to identify buried materials, potential contaminants, trench location, and trench size. The hazards associated with operations at the Source Removal at the Trench 1 site include hazardous substances (chemical and radiological); biological hazards; and physical hazards.

5.1 CHEMICAL HAZARDS

Based on site history and analytical sample results as summarized in the PAM, suspected chemicals of concern (COCs) have been identified at Trench 1. Table 5.1 presents the physical and chemical characteristics for the COCs. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs) and the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs) will be used as guidelines to evaluate potential exposure to the COCs. When present, the PELs and TLVs are the most recent published values. MSDSs for chemical products used on site are located in T900F.

With the exception of diesel combustion gases, chemical exposures during excavation and activities at the SIP are expected to be low and should, under normal on-site operations, remain below allowable levels during site operations. Potential exposures to diesel combustion gases may exceed the PEL/TLV but will be maintained below levels that are Immediately Dangerous to Life and Health (IDLH). In addition, personnel will be wearing Level B or Level C personal protective equipment and following decontamination requirements. These measures should provide adequate protection for site personnel working in the temporary structure.

The primary exposure pathway for the COCs is the inhalation of vapors or contaminated dust particles. However, other pathways such as ingestion, skin contact, and injection are also of concern with these products. Volatile chlorinated hydrocarbons are among some of the chemicals suspected at the site. These VOCs will be in the vapor state at ambient temperatures ($>40°F$) and may pose an inhalation as well as dermal hazard during invasive soil activities.

Potential particulate hazards associated with Trench 1 site activities include uranium metal, uranium oxides, arsenic, beryllium, cadmium, copper, graphite, and cyanide particulates. Most of the products are non-reactive and pose only inhalation or dermal hazards to workers coming in contact with contaminated soil or debris. However, uranium metal is pyrophoric and may present a fire hazard if

encountered. A Fire Prevention Plan is included in Section 8.0.

Real-time air monitoring and personal integrated air sampling will be conducted to locate area with elevated airborne contaminants. On-site health and safety personnel will then recommend measures for control of the contaminant(s) at the source, if possible, and make other specific recommendations to reduce or eliminate the potential for exposure (monitoring requirements are presented in Section 7.4). Dust suppression techniques such as water spraying and careful soil handling shall be used to reduce potential exposures to contaminated airborne dust. Personnel may be exposed to accidental ingestion of contaminants by hand to mouth transfer after contact with contaminated materials. Ingestion of contaminants will be controlled on the site by specific prohibitions, work practices, and requirements for decontamination. Potential collocated worker exposures will be evaluated by continuous perimeter air monitoring for VOCs and particulates (See Section 7.7.6).

5.1.1 Volatile Organic Compounds (VOCs)

Based on historical review, interviews with site personnel, and monitoring well data the volatile organic compounds of concern are suspected to be; carbon tetrachloride, methylene chloride, perchloroethylene (PCE) and trichloroethylene (TCE). The historical record indicates that both TCE and PCE may have been used in building 444 in the machining process. TCE and PCE were also found in ground water samples from monitoring wells adjacent to the trench site. It is believed, however, that the ground water contamination was due to past activities at the 903 Pad area south of the Trench 1 site.

5.1.1.1 Carbon Tetrachloride

Carbon tetrachloride is a colorless, nonflammable liquid with a sweet aromatic odor. The odor threshold for carbon tetrachloride is between 140-580 ppm. This odor threshold is well above the exposure limit requiring the use of supplied air respirators when exposures exceed the exposure guidelines. As with most of the chlorinated solvents burning of this product may release phosgene (choking, irritating gas) and hydrogen chloride.

Exposure to carbon tetrachloride is both a dermal and inhalation hazard. Carbon tetrachloride removes oils from the skin causing fissured dermatitis. Acute inhalation of carbon tetrachloride vapors effect the central nervous system, the liver, and the kidneys. Symptoms typical of acute inhalation exposure are: dizziness, nausea, vomiting, and irritation of the skin and eyes.

Chronic exposure can lead to liver and kidney damage. Central nervous system damage can occur if high long-term exposure have been the rule. Both acute and chronic effects are exacerbated in the presence of ingested alcohol. Carbon tetrachloride is an animal carcinogen and exposure should be kept to a minimum.

5.1.1.2 Methylene Chloride

Methylene chloride is a clear combustible liquid with a chloroform like odor. Methylene chloride has an odor threshold of 160 ppm, six and one-half times the OSHA Permissible Exposure Limit. The poor warning properties exhibited by this product require the use of supplied air respirators if exposures are expected to exceed the Permissible Exposure Limit.

Acute exposure to methylene chloride, like most solvents, produces central nervous system depression. The symptoms associated with acute methylene chloride exposure are: dizziness, staggering gait, blurred vision, nausea, and irritation of the skin and eyes. Liver and kidney damage may also occur in severe cases of overexposure. The body may take as long as two weeks to recover from severe methylene chloride exposures.

Chronic methylene chloride exposure may lead to liver, kidney, central nervous system, heart, and blood damage. Recent studies have indicated that workers exposed to high airborne concentrations of methylene chloride have increased levels of carboxyhemoglobin in the blood. Carboxyhemoglobin is the same product produced by exposure to carbon monoxide and interferes with oxygen transfer by the red blood cells. Many of the effects may have a latency period of several hours. Methylene chloride is a suspected carcinogen and exposure should be kept to a minimum.

5.1.1.3 Perchloroethylene

PCE is a clear nonflammable liquid with a typical chlorinated solvent odor and is used as a cleaner and degreaser. The odor threshold for this chemical is reported to be near 50 ppm, however, the odor may become inconspicuous after a short exposure. Therefore supplied air respiratory protection is required if exposures above the TLV or PEL are anticipated.

Acute exposure to PCE is manifested as central nervous system depression, liver damage, and anesthetic effects. Symptoms of exposure include dizziness, headache, fatigue, and irritation of the eyes, nose, and throat. Most of the symptoms subside with removal from the exposure.

Chronic exposures to PCE may cause liver, kidney, and central nervous system damage. PCE like most chlorinated solvents is a suspected carcinogen and exposure should be kept to a minimum.

5.1.1.4 Trichloroethylene

Trichloroethylene is a colorless, nonflammable, non-corrosive liquid with a sweet odor characteristic of chlorinated solvents. TCE is commonly used in machining operations as a cleaning solvent and degreasing agent. Inhalation of TCE vapors may cause irritation of the nose, eyes, and throat. Acute exposure to this

product depresses the central nervous system exhibiting such symptoms as headache, dizziness, nausea, fatigue, blurred vision, and chemical intoxication. TCE is a suspected carcinogen, linked to liver tumor production in laboratory animals.

The odor threshold for TCE is reported to be 82ppm, well above the TLV of 50 ppm. This poor warning property as well as the cancer potential require the use of supplied air respirators when exposures above the TLV are possible.

5.1.2 Metals

A variety of metals have reportedly been buried in Trench 1 or were used in the processes conducted in building 444. The trench inventory as well as supporting employee interviews indicate the following metals may be encountered during activities conducted as part of the Source Removal at Trench 1:

- Uranium
- Beryllium
- Copper
- Cadmium
- Arsenic

Toxicologically these metals as a group have few similarities. Many of these metals, however, tend to accumulate in the kidneys and the bones. Additionally the hazard posed by heavy metals is that they typically have a long half-life in the body. The two primary routes of entry for metals is via inhalation or ingestion. The use of appropriate personal protective equipment, work practices, site control measures, and decontamination will protect the workers from exposure to metals encountered during Trench 1 activities.

5.1.2.1 Uranium

Uranium is a hard silvery-white radioactive metal found in three naturally occurring isotopic forms: U^{234}, U^{235}, and U^{238}. Depleted uranium (DU) is uranium that contains less of the isotope U^{235} than the naturally occurring fraction. DU, a radioactive metal, is potentially pyrophoric. The radioactive characteristic of the metal does not affect its potential to be pyrophoric. DU's radioactivity hazard is considered to be low, while its toxicity hazard is considered high.

Most metallic uranium is machined in large blocks and does not present a significant fire risk, unless exposed to a severe and prolonged external heat source. Once large blocks of uranium metal are ignited they tend to burn slowly and without a visible flame. Burning uranium does, however, react violently with halogenated hydrocarbons.

Finely divided uranium metal, such as from machining operations (chips), are subject to spontaneous ignition when exposed to air. Once ignited, the finely divided uranium may appear as a bright yellow-red ember and quickly reach a white-hot state.

Many metals, including uranium, form protective oxide layers over the metal surface during the initial stages of oxidation. This coating of oxide greatly reduces the metals ability to ignite spontaneously. Once uranium is completely oxidized it is no longer pyrophoric. Therefore, finer-grained material will completely oxidize more quickly than more massive blocks of material.

Under moist conditions uranium reacts slowly with the available water to form uranium oxide and hydrogen gas. Uranium metal stored under moist conditions tends to react more slowly and the fire hazard is reduced. Uranium forms three common oxides, uranium dioxide (UO_2) a brown to black powder that is relatively insoluble in body fluids, presenting a lung hazard primarily. Uranium trioxide (UO_3) is a brownish-yellow to red powder. This oxide form is slightly more transportable in body fluids posing a greater kidney hazard than the other oxide forms of uranium. If uranium turnings are heated to near 400° F or allowed to react with moist air for long periods of time, U_3O_8 is formed. This black powder is the most chemically stable of the uranium oxides. U_3O_8 is not soluble in body fluids making it primarily a lung hazard to exposed workers.

Uranium and its compounds are highly toxic, with the soluble forms presenting the greatest toxicological hazard. The biologic hazard presented by uranium exposure may manifest itself as chemical toxicity, a radiological hazard, or both. The inhalation of particulate uranium or its compounds present the most likely occupational exposure pathway. Uptake can occur by ingestion, however, absorption in the gastrointestinal track is low. The biological half-life of uranium oxide is typically reported to be 15 days.

Acute uranium poisoning produces damage primarily in the kidneys. Uranium absorbed by the lungs is transferred to the blood producing damage to the kidney tubules and subsequently halting kidney functions.

The chronic toxicological effects of uranium exposure are hard to separate from the radiological hazard posed by long term exposures. As would be expected, chronic exposure to soluble uranium compounds contribute to kidney damage. Chronic exposure to insoluble forms of uranium result in a radiological risk to the lungs.

5.1.2.2 Arsenic

Arsenic is a steel-gray toxic heavy metal widely used in manufacturing industries. Arsenic compounds are typically separated into three classes: 1) inorganic arsenic compounds, 2) organic arsenic compounds, and 3) arsine gas. Arsine gas is by far the most toxic form of arsenic, followed by the trivalent and pentavalent forms, and least toxic being the elemental form of arsenic.

Inhalation of arsenic compounds is a common occupational route of exposure. Inhaled arsenic compounds are often deposited in the upper respiratory tract and cleared from the respiratory system by mucocilliary action, thus resulting in gastrointestinal absorption.

The acute effects of arsenic poisoning generally are seen following ingestion of inorganic arsenic compounds. The symptoms typical of acute poisoning via ingestion are: stomach pain, vomiting, and diarrhea. Acute inhalation of arsenic dust produces chest pain, cough, and headache.

Chronic arsenic exposure may lead to liver or kidney damage. OSHA has linked cancer of the skin, lungs, bone marrow, and lymph glands to chronic arsenic exposure. Symptoms of chronic arsenic exposure are: weight loss, nausea, skin eruptions, hair loss, and peripheral neuritis. Horizontal white lines on the fingernails and toenails are common to chronic arsenic poisoning.

5.1.2.3 Beryllium

Beryllium is a lightweight and strong metal used widely in the nuclear, electronic, and machining industries. Beryllium can be alloyed with a variety of other metals.

Inhalation of beryllium dust is the most common exposure pathway for this metal. Some soluble beryllium salts are linked to skin sensitization and are considered primary irritants. Eye damage as well as nasopharyngitis have also been reported from exposure to beryllium salts.

Beryllium and its compounds are considered highly toxic substances. Acute inhalation of beryllium containing dust typically manifests itself in a nonproductive cough, substernal pain, shortness of breath and weight loss. The degree and speed of onset of these symptoms is dependent upon the type and extent of the exposure. An intense exposure may result in severe pneumonitis leading to pulmonary edema.

Chronic exposure to beryllium dust is considered the primary hazard posed by this metal. The symptoms associated with chronic exposure are similar in nature to those exhibited in acute exposures. Workers with the chronic exposures to this metal may exhibit the following symptoms: respiratory effects (nonproductive cough and shortness of breath), weight loss, fatigue, and weakness. The latency period for onset of the berylliosis may be as long as ten years after the last exposure incident. Chronic beryllium disease manifests itself in a wide range of clinical variants from an asymptomatic non-disabling disease to a severely disabling disease reducing lung efficiency leading to heart failure.

According to the DOE *Historical Release Report,* Building 444 began beryllium operations in 1958. Because the drums in Trench 1 originated from Building 444, potential airborne and surface contamination exposures to beryllium will be evaluated. Airborne levels will be determined through the use of daily personal or area integrated air samples. Surface contamination levels will be determined by obtaining

swipe samples which will be analyzed by a Kaiser-Hill approved laboratory. Due to the homogeneity of waste in the same region of the tench, one swipe will be taken on the outside of every fifth waste package generated from the same area of the trench. The swipe sample will be taken after the waste package has been radiologically free released and prior to exit from the temporary structure. Once outside of the temporary structure, the waste package will be covered with plastic until swipe sample analytical results are received.

If air sample results exceed 0.5 $\mu g/m^3$ or if surface contamination swipe sample results exceed 2.0 $\mu g/ft^2$, the actions in Section 7.7.9 will be followed. NOTE: The 2.0 $\mu g/ft^2$ surface contamination level is pending DOE approval of the Kaiser-Hill *Chronic Beryllium Disease Prevention Program.*

5.1.2.4 Cadmium

Cadmium is a bluish-white metal commonly alloyed with other metals for a variety of uses, including as a neutron absorber in nuclear reactors. This metal is highly corrosion resistant and used as a protective coating for other metals.

Inhalation of cadmium dust or fume is the primary route of entry into the body. Cadmium is not readily absorbed by the gastrointestinal tract or the skin. Cadmium does, however, have a long half-life in the body, concentrating primarily in the liver and kidneys.

Acute toxicity to inhaled cadmium dust typically has a latency period of a few hours following the exposure incident. Symptoms appear progressively as generalized respiratory infection followed by coughing, chest pain, sweating, and chills. Within 24 hours following the exposure severe pulmonary irritation may develop accompanied by shortness of breath, generalized weakness, and may lead to pulmonary edema.

Chronic cadmium poisoning effects the respiratory tract as well as lung function and may lead to a disabling form of emphysema. Other target organs effected by prolonged cadmium exposures are the liver and kidneys. OSHA considers cadmium as a potential kidney carcinogen.

5.1.2.5 Copper

Copper is a soft malleable metal reddish-brown in color. Copper is widely used in industry and is often alloyed with other metals such as tin, zinc, and beryllium. Copper metal typically forms a characteristic greenish oxide when exposed to the environment.

Copper is an essential element in humans with a low toxicity. Incidents of acute copper poisoning are rare and generally not serious. Accounts of copper poisoning typically are the result of ingestion of copper sulfate as a suicide attempt. Nausea, vomiting, diarrhea, and malaise are the symptoms associated with

acute copper exposures. Some copper salts can act as irritants to the skin causing itching and dermatitis.

Chronic exposures to copper can result in perforation of the nasal septum and occurrences of metal fume fever. Metal fume fever is typified by flu-like symptoms dissipating 3-5 days after the exposure has been halted. Workers with Wilson's disease (hepatolenticular degeneration) are more susceptible to copper poisoning because of their abnormally high absorption, retention, and storage of copper in their bodies.

5.1.3 Other Chemical Hazards

5.1.3.1 Carbon Monoxide

Carbon monoxide will be generated during operation of the heavy equipment within the temporary structure, along with oxides of nitrogen and sulfur dioxide which are discussed below. Carbon Monoxide is an odorless and colorless gas commonly generated during the combustion process of fossil fuels. Carbon monoxide is a chemical asphyxiate, interfering with the bodies ability to exchange oxygen in blood. The carbon monoxide molecules rapidly pass from the lungs into the blood stream and attaches itself to the hemoglobin molecule in the blood stream. Hemoglobin has an affinity for carbon monoxide 250 times greater than for oxygen. This increased affinity the hemoglobin molecule has for carbon monoxide produces an added risk for continuous exposure scenarios.

Typical acute symptoms of carbon monoxide exposure are: headaches, dizziness, drowsiness, nausea, and unconsciousness. Death may occur if exposures are high or if moderate to high exposures are experienced over extended periods of time.

Treatment for carbon monoxide poisoning involves removing the individual from the exposure area and possible treatment with oxygen to facilitate the removal of the carbon monoxide from the body. In severe cases of poisoning the individual may be treated in a hyperbaric chamber to speed-up the removal of the carbon monoxide from the blood stream.

5.1.3.2 Cimcool®

Cimcool® is a lathe coolant reportedly used in building 444 during machining and to cover the DU turnings for storage in drums. Because it is not clear as to which Cimcool® was being used during the 1950s and 1960s, a present day Material Safety Data Sheet (MSDS) has been used to estimate that Cimcool® is 65% water, <10% fatty amide, <10% tall oil fatty acid, <10% mineral oil, <10% nitrite, <5% formaldehyde-release biocide, <1% pink dye, <10% dithanolnitrosmide (dissipates in use) silicone antifoam. The product was further diluted with 80% water prior to use as a lathe coolant.

Due to the low volatility of these components, the dilution of the product, and the low toxicity of the

constituents, exposure to this product is not expected to present a serious hazard during Trench 1 activities. Skin contact with the product is likely to be the primary hazard and the proper use of chemical protective clothing will minimize the hazard presented by Cimcool®.

5.1.3.3 Cyanides

The potential to encounter cyanide during Trench 1 activities exists based on the historical record. The cyanide form most-likely to be encountered at Trench 1 are particulates.

The particulate cyanides are typified by sodium or potassium cyanide. Most particulate cyanides are white crystals at room temperature and stable in alkaline solutions. In acidic solutions, however, they release hydrogen cyanide gas.

Cyanides in the particulate form are irritants to mucous membranes. All forms of cyanides act as chemical asphyxiate interfering with the body's oxidative process. Symptoms of acute cyanide exposure are: weakness, vomiting, respiratory collapse and death. Exposure to lower concentrations of cyanide produce headaches, nausea, vomiting, nasal bleeding, weakness, and confusion. Hydrogen cyanide is characterized by a bitter-almond odor near the TLV.

5.1.3.4 Graphite

Graphite may be present since it was used as a packing material for some of the drums that were placed in the trench. Graphite is a black powdered form of carbon. Two forms of graphite are common to industry, natural and synthetic. Both forms are used in the production of foundry molds. The natural form is considered to present the greatest occupational hazard.

The health hazard posed by graphite typically is associated with chronic exposure to the dust. Prolonged exposure to the dust may lead to progressive and disabling pneumoconiosis. Symptoms include headache, coughing, depression, loss of appetite, and shortness of breath. It is unclear as to the direct cause of the disease. Some reports attribute the disease to silica present in the natural form.

5.1.3.5 Hydrogen

Hydrogen is an odorless and colorless gas potentially generated when depleted uranium reacts slowly with water. Hydrogen gas is extremely flammable, with an explosive range between 4-74% in air.

The health hazard posed by hydrogen gas is asphyxiation. There are no PELs or TLVs established for hydrogen. However, at levels that become asphyxiating, the potential fire and explosion hazard become a greater concern.

5.1.3.6 Mineral Oil

Mineral oil will be used in the SIP for inerting depleted uranium that is found in intact or nominally intact drums. Mineral oil is a clear, viscous fluid with a slight odor and is not considered a hazardous chemical by OSHA. The hazard posed by exposure to this low-toxicity material is minimal and the use of protective clothing will prevent skin contact.

5.1.3.7 Oxides of Nitrogen

Diesel exhaust emissions typically have nitrogen dioxide and nitric oxide as part of the exhaust gas stream. Both gases are in low concentrations in the exhaust stream. These gases could accumulate in the temporary structure during operation of the heavy equipment used for excavation.

Nitric oxide is a colorless odorless gas generated during the combustion of fossil fuels. Although present in diesel exhaust emissions, it is oxidized to nitrogen dioxide which is about thirty times more toxic. Nitrogen dioxide is a reddish-brown irritating gas.

Both oxide form of nitrogen are strong mucous membrane and pulmonary irritants. Typical symptoms associated with nitric oxide and nitrogen dioxide exposures are bronchial irritation; burning eyes, nose, and throat; and in severe cases delayed pulmonary edema.

5.1.3.8 Sulfur Dioxide

Sulfur dioxide is a colorless gas with irritating properties similar to those of nitrogen dioxide. Diesel exhaust is a source of sulfur dioxide exposure for workers in the temporary structure.

Sulfur dioxide is a severe irritant, attacking the eyes, nose, throat, and lungs. Acute exposure may cause severe bronchial or lung damage. Chronic exposure result in watery eyes, burning in the nose and throat, and respiratory irritation. Some individuals may become acclimated to low level exposures over time.

Table 5.1
Physical and Chemical Characteristics of Chemicals of Concern

Contaminant (Synonyms) (Abbreviations)	Action Level	OSHA PELS or ACGIH TLVs	NIOSH IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Arsenic (Inorganic compounds, as As) (Arsenia) CAS# 7440-38-2	0.005 mg/m^3	PEL/TLV 0.01 mg/m^3 TWA	Carcinogen 5.0 mg/m^3	Metal. Silver-gray or tin white, brittle, odorless solid. Noncombustible solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame. MW: 74.9 Sp.Gr: 5.73 (Metal) BP: Sublimes VP: 0mm (Approximately) Sol: Insoluble MLT: 1135°F (Sublimes) Fl.P: NA UEL: NA IP: NA LEL: NA	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Ulceration of nasal septum; dermatitis; peripheral neuropathy; gastrointestinal disturbance; respiratory irritation; hyperpigmentation of skin.
Beryllium (Beryllium compounds as Be) CAS# 7440-41-7	0.0005 mg/m^3	PEL/TLV .002 mg/m^3 TWA PEL 0.005 mg/m^3 C (0.025 mg/m^3 30 min max peak)	Carcinogen 4.0 mg/m^3	Metal. A hard, brittle, gray-white solid. Noncombustible solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame. MW: 9.0 Sp.Gr: 1.85 (Metal) BP: 4532°F VP: 0mm (Approximately) Sol: Insoluble MLT: 2349°F Fl.P: NA UEL: NA IP: NA LEL: NA	Inhalation Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Berylliosis (chronic exposure); anorexia, weight loss, weakness, chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; eye irritation; dermatitis.
Cadmium dust (as Cd) CAS# 7440-43-9	0.0025 mg/m^3 (Total) 0.001 mg/m^3 (Resp)	PEL 0.005 mg/m^3 TWA (Total) TLV 0.002 mg/m^3 TWA (Resp)	Carcinogen 9.0 mg/m^3	Metal. Silver-white, blue-tinged, lustrous, odorless solid. Noncombustible in bulk form, but will burn in powder form MW: 1212.4 Sp.Gr: 8.65 (Metal) BP: 1409°F VP: 0mm (Approximately Sol: Insoluble MLT: 610°F Fl.P: NA UEL: NA IP: NA LEL: NA	Inhalation Ingestion	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Pulmonary edema, difficulty breathing, cough, tight chest, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia.
Carbon Monoxide CAS# 630-08-0	12.5 ppm	TLV 25 ppm TWA	1200 ppm	Colorless, odorless gas MW: 28.0 Sp.Gr: NA BP: -313 °F VP: > 35 Atm Sol: 2% MLT:-337°F Fl.P: NA UEL: 74% IP: 14.01eV LEL: 12.5% OT: Odorless VD: 0.97	Inhalation	Fresh air; Seek medical attention	Headache, nausea, weakness, dizziness
Carbon Tetrachloride (Tetrachloromethane) CAS# 56-23-5	2.5 ppm Skin	TLV 5 ppm TWA 10 ppm STEL PEL 25 ppm C (200 ppm - 5 min max peak in any 4 hrs)	Carcinogen 200 ppm	Colorless liquid with a characteristic ether-like odor. Noncombustible liquid. MW: 153.8 Sp.Gr: 1.59 BP: 170°F VP: 91mm Sol: 0.05% FRZ: -9°F Fl.P: NA UEL: NA IP: 11.47eV LEL: NA OT: 140-584 ppm VD: 5.32	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	CNS depression; nausea and vomiting; liver and kidney damage; skin and eye irritation; drowsiness, dizziness, incoordination.

Table 5.1 (Continued)
Physical and Chemical Characteristics of Chemicals of Concern

Contaminant (Synonyms) (Abbreviations)	Action Level	OSHA PELS or ACGIH TLVs	NIOSH IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Copper (dusts and mists) CAS# 7440-50-8	0.5 mg/m³	PEL 1.0 mg/m³ TWA	100.0 mg/m³	Reddish, lustrous, malleable, odorless, solid. Noncombustible solid in bulk form, but powdered form may ignite. MW: 63.5 Sp.Gr: 8.94 BP: 4703°F VP: 0mm (Approximately) Sol: Insoluble MLT: 1981°F Fl.P: NA UEL: NA IP: NA LEL: NA	Inhalation Ingestion Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Irritates eyes, skin, and respiratory system; liver and kidney damage; increased risk of Wilson's disease.
Cyanide (as CN) (Sodium Cyanide) (Potassium Cyanide) CAS# 151-50-8	2.5 mg/m³	PEL 5.0 mg/m³ TWA 5.0 mg/m³ C	25 mg/m³	White, granular or crystalline solid with a faint, almond-like odor. Noncombustible solid, but contact with acids releases highly flammable hydrogen cyanide. MW: 49.0, 65.1 Sp.Gr: 1.60, 1.55 BP: 2725°F, 2957°F VP: 0mm (Approximately) Sol: 58%, 77%(77°F) MLT: 1047°F, 1173°F Fl.P: NA UEL: NA IP: NA LEL: NA	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Irritates eyes, skin, and upper respiratory system; asphyxia; weakness, headache, confusion; nausea, vomiting; increased respiratory rate; slow grasping respiration, thyroid and blood changes
Graphite (natural) (Black Lead) (Mineral Carbon) (Plumbago) (Silver Graphite) (Stove Black) CAS# 7782-42-5	1.0 mg/m³	TLV 2.0 mg/m³ TWA	1250 mg/m³	Steel gray to black, greasy feeling, odorless solid. Combustible solid. MW: 12.0 Sp.Gr: 2.0 - 2.25 BP: Sublimes VP: 0mm (Approximately) Sol: Insoluble MLT: 6602°F (Sublimes) Fl.P: NA UEL: NA IP: NA LEL: NA	Inhalation Contact	Fresh air; Seek medical attention; Irrigate and wash area affected immediately.	Cough, difficulty breathing, black sputum, decreased pulmonary function, lung fibrosis.
Hydrogen (Protinium) CAS# 1333-74-0	10%LEL	NA Simple Asphyxiate	NA	Colorless, odorless, flammable gas. MW: 2.02 Sp.G: 0.070@BP BP: -423°F VP: Unknown Sol: 2%v/v (32°F FRZ: -434.6°F Fl.P: NA UEL: 75% IP: 13.598 eV LEL: 4.0% OT: Odorless VD: 0.069	Inhalation Contact	Fresh air: Treat for possible frostbite.	
Hydrogen Cyanide (Formonitrile) (Hydrocyanic Acid) (Prussic Acid) CAS# 74-90-8	2 ppm	TLV 4.7 ppm C [Skin]	50 ppm	Colorless or pale-blue liquid or gas (above 78°F) with a bitter almond-like odor. Class 1A flammable liquid. Flammable gas. MW: 27.0 Sp.Gr: 0.69 BP: 78°F VP: 630mm Sol: Miscible FRZ: 7°F Fl.P: 0°F UEL: 40% IP: 13.60eV LEL: 5.6% OT: 4.7 ppm VD: 0.94	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Asphyxia; weakness, headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and grasping; thyroid and blood changes.

Table 5.1 (Continued)
Physical and Chemical Characteristics of Chemicals of Concern

Contaminant (Synonyms) (Abbreviations)	Action Level	OSHA PELS or ACGIH TLVs	NIOSH IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Methylene Chloride (Dichloromethane) (Methylene Dichloride) CAS# 75-09-2	12.5 ppm	PEL 25 ppm TWA 125 ppm STEL	Carcinogen 2300 ppm	Colorless liquid with chloroform-like odor; Combustible liquid. MW: 84.9 Sp.Gr: 1.33 BP: 104°F VP: 350mm Sol: 2.0% FRZ: -139°F Fl.P: ? UEL: 23% IP: 11.32eV LEL: 13% OT: 160 ppm VD: 2.93	Inhalation Ingestion Contact Absorption	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Fatigue, weakness, sleepiness, lightheadedness; numbness and tingling in limbs; nausea; skin and eye irritation.
Nitric oxide (Nitrogen Monoxide) CAS# 10102-43-9	12.5 ppm	PEL/TLV 25 ppm TWA	100 ppm	Colorless, odorless gas MW: 30.0 Sp.Gr: NA BP: -241 °F VP: > 34.2 Atm Sol: 5% MLT:-263°F Fl.P: NA UEL: NA IP: 9.271eV LEL: NA OT: NA VD: 1.04	Inhalation	Fresh air, seek medical attention	Eye, nose, throat, and respiratory irritation
Nitrogen Dioxide CAS# 10102-44-0	1.5 ppm	TLV 3 ppm TWA 5 ppm STEL	20 ppm	Reddish-brown, irritating gas MW: 30.0 Sp.Gr: NA BP: 70 °F VP: 720 mm Sol: Reacts MLT:15 °F Fl.P: NA UEL: NA IP: 9.75eV LEL: NA OT: 0.06-0.1 ppm VD:1.58	Inhalation	Fresh air, seek medical attention	Eye, nose, throat, and respiratory irritation
Nuisance Dusts ("Inert Dusts") (PNOR) CAS# NA	1.5 mg/m^3 (Resp)	TLV 3.0 mg/m^3 TWA (Resp)	N.D.	Properties vary depending upon the specific solid.	Inhalation Contact	Fresh air, seek medical attention: Irrigate area affected immediately.	Eye, skin, throat, and respiratory irritation
Sulfur Dioxide CAS# 7446-09-5	1 ppm	TLV 2 ppm TWA 5 ppm STEL	100 ppm	Colorless, irritating gas MW: 64.1 Sp.Gr: NA BP: 14 °F VP: 3.2 Atm Sol: 10 MLT:-104 °F Fl.P: NA UEL: NA IP: 12.3eV LEL: NA OT: 2.7 ppm VD: 2.24	Inhalation	Fresh air, Seek medical attention	Eye, nose, throat, and respiratory irritation

Table 5.1 (Continued)
Physical and Chemical Characteristics of Chemicals of Concern

Contaminant (Synonyms) (Abbreviations)	Action Level	OSHA PELS or ACGIH TLVs	NIOSH IDLH	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Tetrachloroethylene (Perchloroethylene) (Tetrachloroethene) (Perk) (PCE) CAS# 127-18-4	12.5 ppm	TLV 25 ppm TWA 100ppm STEL PEL 200 ppm C (300 ppm - 5 min max peak in any 3 hrs)	Carcinogen 150 ppm	Colorless liquid with a mild chloroform-like odor. Noncombustible liquid. MW: 165.8 Sp.Gr: 1.62 BP: 250°F VP: 14mm Sol: 0.02% FRZ: -2°F Fl.P: NA UEL: NA IP: 9.32eV LEL: NA OT: 47 ppm VD: 5.7	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Eye, nose, throat irritation; nausea; flush face and neck; vertigo, dizziness, incoordination, headache, sleepiness; skin erythema; liver damage.
Trichloroethylene (Ethylene Trichloride) (Trichloroethene) (TCE) CAS# 79-01-6	25 ppm	TLV 50 ppm TWA 100ppm STEL PEL 200 ppm C (300 ppm - 5 min max peak in any 2 hrs)	Carcinogen 1,000 ppm	Colorless liquid with a chloroform-like odor. Combustible liquid. MW: 131.4 Sp.Gr: 1.46 BP: 189°F VP: 58mm Sol: 0.0001% FRZ: -99°F Fl.P: ? UEL: 10.5% IP: 9.45eV LEL: 8% OT: 82 ppm VD: 4.53	Inhalation Ingestion Absorption Contact	Artificial respiration; Seek medical attention; Irrigate and wash area affected immediately.	Headache, vertigo; visual disturbance, fatigue, giddiness, tremor, sleepiness, vomiting, nausea; dermatitis, cardiac arrhythmias, paresthesia; eye and skin irritation; liver damage

Table 5.1 (Continued)
Physical and Chemical Characteristics of Chemicals of Concern

Key:

ACGIH - American Conference of Governmental Industrial Hygienists
BP - Boiling point
C - Ceiling-Concentration shall not be exceeded at any time
CNS - Central nervous system
Fl. pt. - Flash point-the temperature at which the liquid phase gives off enough vapor to flash when exposed to an external ignition source. Closed cup, unless otherwise noted
FRZ - Freezing point for liquids and gases, °F
IDLH - Immediately Dangerous to Life and Health-Maximum concentration from which one could escape within 30 minutes without experiencing any irreversible health effects
IP - Ionization potential, eV (electron volts)
LEL - Lower explosive (flammable) limit in air, % by volume
mg/m^3 - milligrams per cubic meter
MW - Molecular weight
NA - Not applicable
N.D. - Not Determined
OSHA - Occupational Safety and Health Administration
OT - Odor Threshold
PEL - Permissible Exposure Limit-Concentration is a time weighted average (TWA) that must not be exceeded during any 8-hour workshift of a 40-hour workweek. (OSHA)
PPM - Parts per million
Resp - Respirable fraction
Skin - Potential significant contribution to the overall exposure by the cutaneous route, including mucous membranes and the eyes, either by contact with vapors or, of probable greater significance, by direct skin contact with the substance.
Sol - Solubility in water at 68°F, % by weight.
Sp.Gr - Specific gravity at 68°F referenced to water at 39.2°F
STEL - Short Term Exposure Limit-A 15-minute average concentration which should not be exceeded at any time during a workday. Exposure over the PEL or TLV up to the STEL should be no longer than 15 minutes and should not occur more than four times per day. There should be at least 60 minutes between successive exposures in this range.
Sublimes - A process in which a material passes directly from a solid into a gaseous state and condenses to form solid crystals, without liquefying.
TLV - Threshold Limit Value-Concentration that nearly all workers may be repeatedly exposed, day after day, without adverse effect. (Based on an 8-hour workday and 40-hour workweek). (ACGIH)
UEL - Upper explosive (flammable) limit in air, % by volume
VD - Vapor Density
VP - Vapor pressure at 68°F in millimeters (mm) mercury (Hg) unless otherwise noted.

References:

Air Contaminants- Permissible Exposure Limits (29 CFR 1910.1000-.1051).

American Conference of Governmental Industrial Hygienists, Threshold Limit Values and Biological Exposure Indices for 1997.

National Institute of Occupational Safety and Health, Pocket Guide to Chemical Hazards, June, 1997.

5.2 RADIOLOGICAL HAZARDS

Based on analytical sample results, the historical record, and interviews with workers, Americium^{241}, Plutonium$^{239/240}$, Uranium$^{233/234}$, Uranium^{235}, and Uranium^{238} are likely to be encountered during Trench 1 activities. Of these radionuclides, U^{238} is expected to be the most predominant, while americium and plutonium levels are expected to be low or at trace levels. The physical and chemical characteristics of the radionuclides are presented in Table 5.2.

Radiological hazards, including potential collocated worker exposure, associated with the Trench 1 Area will be controlled by the implementation of a rigorous radiological control program which includes the following aspects:

- strict adherence to Radiological Work Permits;
- use of a high volume and low volume radiological air samplers;
- the operation of Continuous Air Monitors (CAMs);
- contamination control surveys;
- radiation surveys;
- personnel frisking for radiological contamination; and
- aggressive dust suppression.

The radiological hazards can be broken down into two distinct categories: external radiation exposure, and internal radiation exposure.

5.2.1 External Radiation Exposure

Beta and gamma radiations are emitted by the radionuclides which are buried at the Trench 1 site. However, the primary radiation hazard at Trench 1 is anticipated to be the beta radiation emitted by the U^{238}. Beta radiation travels a relatively short distance and cannot penetrate beyond the shallow layers of the skin or the lens of the eye, and so associated hazards are confined to these areas when in close proximity to the source. Eye and skin exposure to external beta radiation is greatly reduced or eliminated through the use of eye protection, personal protective clothing, and work practices such as remote handling.

External gamma radiation, unlike beta radiation, readily penetrates deep into the body and is therefore hazardous to internal organs. Clothing and eye protection are not effective at reducing external gamma radiation exposure. Four accepted methods to minimize gamma exposures are:

- the use of shielding between personnel and the radiation source;
- minimizing time in the radiation area;
- maximizing distance from the radiation source; and
- reducing or minimizing the source of radiation.

Due to low levels of gamma radiation, external shielding designed to reduce gamma radiation exposure will not be necessary for workers at Trench 1. Should external radiation be of concern, the most effective methods of reducing worker exposure to external gamma radiation will be by posting areas where elevated gamma exposure rates exist and limiting the amount of time workers spend in these areas. Work assignments will also be evaluated to ensure that personnel are maintaining a maximum possible distance from gamma radiation sources.

Potential external radiation exposures will be characterized through the use of real-time radiation monitoring and tracked through the use of whole body, area, and extremity dosimeters as required by Radiological Engineering.

5.2.2 Internal Radiation Exposure

Alpha and beta radiation are a significant hazard when deposited in internal organs. Alpha and beta radiation are principally admitted into the body by inhalation of airborne contamination but ingestion, injection, and absorption of surface contamination through the skin are also possible. Radioactive contamination existing in the form of loose material is capable of migrating or being transported by a variety of mechanisms such as movement of personnel, vehicles, equipment, and wind.

Particulates that are suspended or have settled out on horizontal surfaces (equipment) and have been re-suspended pose an inhalation hazard. Drinking contaminated water, eating contaminated food, and/or transferring contamination to the mouth pose an ingestion hazard. Abrasions, lacerations, or punctures of the skin resulting from contact with contaminated surfaces pose an injection hazard. Absorption hazards exist when radioactive isotopes are chemically incorporated in a substance that is able to permeate the skin.

Exposure to radioactive contamination and the potential for internal contamination will be controlled by the proper use and removal of PPE; administrative controls including prohibitions against smoking, eating, drinking and chewing; and proper use of respirators when airborne contamination above prescribed limits is suspected.

Potential internal radiation exposures will be evaluated through the use of low and high volume radiological sampling and tracked through the use of project specific bioassays.

Table 5.2
Physical and Chemical Characteristics of Radionuclides of Concern

Contaminant (Synonyms) (Abbreviations)	OSHA PELS or ACGIH TLVs[1]	NIOSH IDLH[1]	Physical/Chemical Characteristics	Routes of Exposure	First Aid	Exposure Symptoms
Americium 241 (Am-241)	5 rem/yr 2 X 10^{-12} uCi/ml DAC[2]	Carcinogen	Silvery, somewhat malleable radioactive metal.	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Plutonium 239/240	5 rem/yr 2 X 10^{-12} uCi/ml DAC	Carcinogen	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Uranium 233/234	5 rem/yr 2 X 10^{-11} uCi/ml DAC 0.05 mg/m^3-TWA 0.06 mg/m^3-C	Carcinogen 10 mg/m^3	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Uranium 235	5 rem/yr 2 X 10^{-11} uCi/ml DAC 0.05 mg/m^3-TWA 0.06 mg/m^3-C	Carcinogen 10 mg/m^3	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures
Uranium 238	5 rem/yr 2 X 10^{-11} uCi/ml DAC 0.05 mg/m^3-TWA 0.06 mg/m^3-C	Carcinogen 10 mg/m^3	Silvery, radioactive metal	Inhalation Ingestion Absorption Contact	Follow directions of on-site Radiological Personnel.	No acute symptoms from low level exposures

[1] mg/m^3 are for chemical properties.
[2] DAC - Derived Air Concentration

5.3 BIOLOGICAL HAZARDS

During field work at this site, personnel may encounter a wide variety of biological hazards such as insects, spiders, reptiles, and mammals. Biological hazards may act as infectious, allergenic, or toxic agents to the workers.

5.3.1 Insects

The most common insects of concern at the RFETS area are: bees, wasps and hornets. Stings of these insects may cause serious allergic reactions in certain individuals. Personnel with known insect allergies or sensitivities should notify the SSO before field work begins. If a person is stung by a bee, wasp, or hornet, resulting in a medical emergency, call extension 2911 and notify the Site Safety Officer or Field Supervisor.

5.3.2 Arachnids

Ticks and spiders are the two most common types of arachnid hazards encountered at the RFETS site. Ticks are parasites that feed on the blood of an animal/human host and can carry several severe diseases, the least severe bringing several days of fever and pain and the worst causing brain damage. Ticks are picked up on clothing in grassy areas of the site. Preventative measures include careful inspection of clothing and body parts at the end of each day. In the event that someone is bitten by a tick it should be reported to the Site Safety Officer or Field Supervisor for medical assistance if required.

Poisonous spiders are also a potential biohazard for field personnel. Black widow spiders are nocturnal hunters and consequently may be present under rocks or other ground debris during daylight hours. Care should be taken when moving or rummaging in such areas and the use of gloves is required. If site personnel encounter a black widow and are bitten call extension 2911 and notify the Site Safety Officer or Field Supervisor.

5.3.3 Snakes

Poisonous snakes may also be encountered at the site. Site workers should exercise caution for the presence of rattlesnake at the site. Personnel should visually check before reaching into a covered area and walking through grassy areas. If a person is bitten by a snake, call extension 2911 and notify the Site Safety Officer or Field Supervisor.

5.3.4 Mammals

Rodents, coyotes and foxes are some of the mammals indigenous to the RFETS. They are typically fearful of humans and will try to escape if encountered. These animals may become aggressive when defending their young, their dens, or when they are sick or injured. Personnel should avoid contact with any of these animals and contact Randy Guild at Ext. 5302 for disposition. If bitten by an animal exhibiting uncharacteristic behavior, there is the possibility that the animal has rabies. If the animal can be captured or contained ***safely***, it can be tested for the presence of rabies. If a person is bitten, call extension 2911 and notify the Site Safety Officer or Field Supervisor.

5.3.5 Poisonous Plants

The most common poisonous plant in this area is poison ivy. Allergic contact dermatitis due to contact with the plant leaves or stems is the most common response reported by field personnel. Contact with this plant should be avoided. In the event that the contact with the plant is unavoidable, protective gloves and clothing shall be worn.

5.4 PHYSICAL HAZARDS

The following sections discuss physical hazards and the measures to be taken to control the hazards.

5.4.1 Heavy Equipment Hazards

The operation of heavy equipment poses a hazard to personnel, equipment, and property. Control measures for the safe operation of heavy equipment will include:

- heavy equipment will be inspected by RMRS Health and Safety prior to project execution;
- hoisting equipment will be inspected by RMRS Health and Safety prior to project execution;
- heavy equipment will have rollover protection systems;
- operators will be properly trained in the use and limitations of the specific pieces of heavy equipment being operated;
- heavy equipment will be inspected by the operator prior to the beginning of each shift and an equipment specific inspection checklist located in the cab will be completed;
- seat belts will be worn by heavy equipment operators at all times;
- at a minimum, all heavy equipment will be equipped with a 10 lb. ABC fire extinguisher;
- establishing heavy equipment roadways and operating areas;
- ground personnel in the HCA/EZ and CA/EZ in the main body of the temporary structure will wear orange reflective vests, or equivalent, when heavy equipment is in use;

- ground personnel in the support zone will wear orange reflective vests and hard hats when heavy equipment is in use;
- personnel will stay at a safe distance from all heavy equipment and maintain line of sight with the operator;
- when sampling or obtaining readings at the excavator or front-end loader buckets, the operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that ground personnel may approach;
- at no time will any personnel position themselves under hydraulically operated equipment or loads; and
- non-routine backing up of heavy equipment will require a spotter to ensure that the path of travel is clear. In addition, all heavy equipment will have electronic backup alarms which will sound continuously while the equipment is backing.

5.4.2 Excavation Hazards

Excavations pose a hazard due to cave-ins, slips, trips, falls, and underground utilities. Measures used to control these hazards include:

- the preparation and approval of Soil Disturbance Permits which address overhead and underground utility hazards;
- the excavation will be inspected by a competent person (Health and Safety Specialist) prior to each shift, during each shift, and immediately after any rain or snow storms or other hazard increasing occurrences;
- heavy equipment entry into the excavation will not be permitted unless the excavation is properly sloped and entry approval has been obtained from a Kaiser-Hill Excavation Specialist;
- heavy equipment will not be allowed on the north side of the excavation;
- the excavator will be operated in accordance with the manufacturers recommendations in regards to safe operating distances from the excavation;
- at no time will the counterweight on the excavator be positioned above the open excavation;
- a spotter will be present during all excavation activities;
- personnel entry into the excavation will not be permitted unless the excavation is properly sloped and entry approval has been obtained from a Kaiser-Hill Excavation Specialist;
- a warning system such as cones or a rope will be established and personnel will stay a minimum of six feet away from the edge of the excavation when it is not sloped at 1.5:1;
- personnel closer than six feet to the excavation must wear a full body harness and lifeline attached to an approved anchorage point; and

- equipment, except the excavator, will be kept a minimum of two feet away from the edge of the excavation when it is not sloped at 1.5:1.

5.4.3 Noise Exposure Hazards

Work at the site will expose personnel to high noise levels from the operation of heavy equipment and power tools. Excessive noise exposure can cause both temporary and permanent effects on hearing. The temporary effects of excessive noise include ringing in the ears, interference with communication, and hearing threshold changes. The effect of long-term excessive noise includes varying degrees of noise-induced hearing loss. Measures used to control noise exposure hazards will include:

- noise monitoring to determine employee exposure;
- the posting of areas where hearing protection is required;
- hearing protection for exposures of greater than 85 dBA for any length of time;
- noise monitoring to confirm the effectiveness of the hearing protection worn; and
- noise dosimetry to determine employee exposure and whether participation in the Hearing Conservation Program is required. The Hearing Conservation Program includes both training and audiometric testing.

5.4.4 Heat and Cold Stress Hazards

During operations there is a potential for worker exposure to serious temperature extremes. These environmental conditions increase the risk of heat or cold stress during field activities. Measures used to control heat stress exposure will include:

- briefing employees on the causes, prevention, signs/symptoms, and treatment of heat stress;
- monitoring for exposure to heat stress using a Wet Bulb Globe Thermometer (WBGT);
- proper monitoring of employee physiology including heart rate and oral temperature;
- wearing ice vests or other RMRS approved measures;
- instituting a work-rest regimen based on the ACGIH guidelines (See Appendix C);
- providing personnel with a shaded break area and cool liquids; and
- providing for proper acclimatization of all workers to new or changing work conditions.

Measures used to control cold stress exposure will include:

- briefing employees on the causes, prevention, signs/symptoms, and treatment of cold stress;
- monitoring for exposure to cold stress using a dry bulb thermometer and anemometer;

- wearing adequate insulating dry clothing when the air speed and temperature result in an equivalent chill temperature of $<40°F$;
- changing wet clothing;
- instituting a work-warming regimen based on the ACGIH guidelines (See Appendix C) when the equivalent chill temperature is $<19.4°F$;
- providing personnel with a heated break area and warm sweet drinks;
- taking special precautions when handling evaporative liquids such as gasoline at equivalent chill temperatures $<39.2°F$; and
- providing for proper acclimatization of all workers to new or changing work conditions.

5.4.5 Personal Protective Equipment (PPE) Hazards

PPE will be required for most activities placing a physical and mental strain on the wearer. When PPE such as SCBAs, airline respirators, gloves, shoe covers, and protective anti-C coveralls are worn, visibility, hearing, manual dexterity, and communications are impaired. Additionally, the risk of heat stress increases. Measures used to control these hazards will include:

- minimizing the number of personnel entering areas requiring PPE;
- PPE will be inspected prior to use;
- keeping the work area clear of trip hazards through diligent housekeeping;
- providing radios for communication;
- developing hand signals for communication;
- use the buddy system to ensure clothing integrity; and
- monitoring for and preventing heat stress as described above.

5.4.6 Overhead Power Line Hazards

Special precautions must be taken when working or operating heavy equipment in the vicinity of overhead energized power lines. Contact with electrical power lines can cause shock, burns, or death. Measures used to control overhead power line hazards will include:

- assume all overhead lines are energized;
- heavy equipment will be operated with a 10' minimum clearance between power lines and any part of the equipment; and
- strictly adhering to RFETS Health and Safety Practices Manual (HSP) 2.08, *Lock Out/Tag Out* when conducting lock out/tag out operations on overhead lines.

5.4.7 Vehicular Traffic Hazards

Due to the large number of expected vehicles, limited space at the Trench 1 Site, and the hazard associated with crossing roads during peak traffic periods, the areas north and east of the site will be used for parking. In addition, some work will be conducted along northernmost inbound lane from the east gate which is the southern boundary of the Trench 1 Site. Employees shall exhibit special caution when accessing the site along active roadways and when working along active roadways . Measures used to control traffic hazards will include:

- wearing orange vests when working near active roadways;
- positioning flagpersons along active roadways to control traffic;
- closing roads as needed; and
- placing jersey barriers around regularly occupied work areas.

5.4.8 Portable Electric Generator Hazards

Due to a lack of permanently installed electrical power, portable electric generators will be used during the project. Generators may be used to power portable hand tools and light stands, pumps, and the radiological air samplers. Measures used to control the hazards associated with the use of generators will include:

- extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage;
- any extension cords which show signs of damage or deterioration will be immediately tagged out of service;
- generators will be equipped with GFCI outlets which will be tested daily by the user;
- generators will be properly grounded via a ground rod as required;
- a 10 lb. ABC fire extinguisher will be located next to all generators;
- refueling will be conducted at the beginning of the shift when the generators are cool; and
- refueling will be conducted with the generator on the ground surface or with the generator grounded to the fuel dispenser.

The RFETS Lock Out/Tag Out Program (HSP 2.08) will be ***strictly*** adhered to during the servicing and maintenance of machines or equipment in which the unexpected energization or start up of the machine or equipment, or release of stored energy could cause injury to personnel.

5.4.9 Hand Tool Hazards

The improper use of hand tools can result in injury to personnel and damage to property. Hand tools will be used for decontaminating equipment, handling debris, sealing waste packages, and other activities. Measures used to protect personnel and equipment will include:

- hand tools will be inspected by the user prior to use;
- hand tools will be used for their intended use and operated in accordance with HSP-12.10, *Hand and Portable Power Tools*;
- portable power tool guards will be in place and no modifications will be made;
- portable power tools will be plugged into GFCI protected outlets; and
- portable power tools will be UL listed and have a three wire grounded plug or be double insulated.

5.4.10 Compressed Gas Hazards

Compressed gas cylinders and systems pose a hazard to personnel and property due to unknown contents, misuse, and rupture. The use of compressed gas cylinders and systems during the project will be those associated with the supplied airline respirators, SCBA systems, and Industrial Hygiene and Radiological Control Technicians operations. Measures used to control the use of compressed gas cylinders and systems will include:

- obtaining certification papers with all breathing air or other compressed gas shipments;
- ensuring that personnel operating the breathing air supply compressors and system are familiar with the system and have current Pressure Safety Awareness training;
- ensuring that all cylinders and systems are properly labeled;
- inspecting cylinders and systems prior to and during each shift;
- restricting smoking in areas where cylinders containing flammable gases are stored;
- heavy equipment operators will inspect heavy equipment mounted airline bottles prior to and during each shift;
- breathing air cylinders will be secured;
- securing cylinders in the upright position; and
- properly tightening all fittings and connections.

5.4.11 Hoisting and Rigging Equipment Hazards

Hoisting and rigging equipment poses a unique hazard due to the possibility of sudden failure resulting in property damage or personal injury. Hoisting and rigging equipment will be used to overpack intact drums. Measures used to control the use of hoisting and rigging equipment will include:

- hoisting equipment from off site vendors will be inspected by RMRS Health and Safety;
- operators will be properly trained in the use and limitations of the specific pieces of hoisting equipment being operated;
- use of Hoisting and Rigging Checklist as required by HSP 12.02, *Hoisting and Rigging*;
- hoisting equipment will be inspected by the operator prior to the beginning of each shift and an inspection checklist will be completed;
- rigging equipment will be properly tagged, if required, and inspected by the user prior to use on a daily basis;
- any rigging equipment which show signs of damage or deterioration will be immediately tagged out of service;
- ensuring that all rigging equipment is properly positioned;
- at no time will any personnel position themselves under hoisted loads;
- ground personnel will wear orange vests, or equivalent, and maintain line of site with the operator; and
- a Hoisting and Rigging Plan will be developed for the overpacking of intact drums.

5.4.12 Fork Truck Hazards

The operation of fork trucks pose a hazard to personnel, equipment, and property when moving waste packages and other materials. Control measures for the safe operation of fork trucks will include:

- fork truck operators will hold a current Fork Truck Operator Permit;
- fork trucks will be inspected by the operator prior to the beginning of each shift and an inspection checklist will be completed in accordance with HSP-9.06 *Powered Industrial Trucks*;
- fork trucks will be equipped with electronic backup alarms;
- ground personnel will wear orange vests, or equivalent, and maintain line of site with the operator; and
- all unstable loads will be secured.

5.4.13 Ladder Hazards

Work on ladders poses a hazard due to falls and ladder failure. Ladders will be used to access elevated areas such as parts of heavy equipment and the tent during decontamination and survey work. Control measures for the use of ladders will include:

- ladder users will have current Ladder Safety Awareness training;
- ladders will be Type 1-A, Industrial Extra Heavy Duty or better;
- aluminum ladders will not be used in areas where there is electrical power equipment;

- three legged ladders are strictly prohibited;
- ladders will be inspected by the user prior to use on a daily basis;
- ladders which show signs of damage or deterioration will be immediately tagged out of service;
- ladders will be used for their intended purpose; and
- work on ladders at heights greater than six feet will require evaluation from the SSO.

5.4.14 Elevated Work Hazards

Unprotected elevated work at heights greater than six feet poses a hazard due to the potential for falls. Prior to wearing fall arrest equipment when conducting activities such as decontaminating and surveying heavy equipment and the tent, attempts will be made to eliminate the hazard. If, however, the hazard cannot be eliminated and fall arrest equipment must be worn, the following control measures will be followed:

- personnel shall have current Fall Protection qualification;
- fall arrest equipment will be inspected by the user prior to use on a daily basis;
- fall arrest equipment which show signs of damage or deterioration will be immediately tagged out of service; and
- the fall arrest system will consist of a full body harness, shock absorbing lanyard, and an anchorage point approved by RMRS health and safety.

5.4.15 Flammable or Combustible Liquid Storage Hazards

Hazards associated with improper flammable or combustible liquid storage, such as safety cans used to fuel pumps and generators, include fires and spills. Work controls involved with flammable or combustible liquid storage include:

- gasoline containers will be metal safety cans in good repair;
- containers will be equipped with spring loaded closing devices and flame arresters;
- containers will be properly labeled; and
- containers will be stored in approved flammable storage cabinets when not in use.

5.4.16 Drum Handling Hazards

Personnel working on the project will be required to handle drums during characterization, sampling, inerting, packaging, and staging activities. Hazards related to improper drum handling include personnel injury and material spills/releases. Because of these hazards it is important to stage drums in a manner

which allows for access by the fork lift/drum grabber. Work controls involving drum handling with a fork truck equipped with a drum grabber include the following:

- a fork truck equipped with a drum grabber will be used to move drums whenever feasible;
- the qualified fork truck operator and ground personnel will be familiar with the use and limitations of the drum grabber device; and
- ground personnel will confirm that the drum grabber device is secure around the drum and signal the fork truck operator prior to the drum being moved.

If a drum must be manually moved so that the fork truck can gain access, the following controls will be employed:

- footing surfaces will be free of slip hazards such as water or oil and the path of travel will be free of trip hazards;
- hands will be placed at approximately ten and two o'clock;
- pinch points will be identified and removed if possible;
- personnel will position themselves so that their backs are straight and knees are slightly bent;
- the drum will be slowly tilted so that the tipping point is not exceeded;
- if the drum is too heavy to be easily tipped, personnel will not attempt to tilt the drum using jerking motions which could lead to back injury and will request help from additional personnel; and
- hands will be slid along the drum ring in a manner which prevents the crossing over of arms.

5.4.17 Pinch Point Hazards

Pinch point hazards exist when putting lids on containers and during the general handling of materials. Potential consequences of getting caught in a pinch point include damage to personal protective equipment and personnel injury. Work controls involving pinch points are as follows:

- personnel should evaluate the work being performed for the presence of pinch points;
- heavy duty leather gloves shall be worn during activities involving pinch points;
- workers should remain alert to the tasks they are performing; and
- personnel in the area should avoid distracting coworkers involved in activities such as putting the lids on waste containers.

5.4.18 ConCover® Machine Hazards

During the project activities a soil stabilizing product known as ConCover® may be applied. Hazards associated with the ConCover® machine include inhalation of silica during the mixing of the two.part solution, contact with rotating internal parts, exposure to high pressure liquids, and falling from the unit while in transport. Control measures for the use of the ConCover® machine include:

- at a minimum, a full-facepiece air-purifying respirator with HEPA cartridges will be worn during mixing of the two part solution;
- personnel will not reach into the machine during the mixing of the solution;
- at no time will the nozzle be pointed at any body part or other personnel; and
- operators will ride only in the approved area while in transport and the restraint device(s) will be in place.

5.4.19 High Temperature, High Pressure Decontamination System Hazards

Should the use of a high temperature, high pressure decontamination system be required in the field, personnel will have current Pressure Safety II training and the following control measures will be implemented:

- personnel will be briefed on the use of the system;
- the wand, trigger mechanism, hoses, and temperature/pressure generating unit will be inspected by the user prior to use;
- at no time will the wand be pointed at any body part or other personnel; and
- polycoated Anti-Cs, 16" high hard toed rubber boots, safety glasses, hard hat with face shield, and inner and outer nitrile gloves will be worn at a minimum.

5.4.20 Slip, Trip, Fall Hazards

Slip, trip, fall hazards are generally attributable to poor housekeeping. Adverse weather condition may also contribute to slip, trip, and fall hazards. Although the majority of the operations will be contained inside a weatherproof structure, support activities outside the structure may lend themselves to slip/fall hazards. All work areas shall be kept free of tripping hazards, free of water, ice or snow to the extent necessary to perform the required work in a safe manner. Slip, trip, and fall control measures include:

- daily inspection shall be conducted by the HSS to assure the work area is free of trip/fall hazards and a high level of housekeeping will be maintained;
- ice and snow shall be removed or treated with gravel in work areas to provide a safe walking surface; and

- equipment located in the work area that could present a trip hazard shall be removed or labeled with yellow and black stripped caution tape.

5.4.21 Aerial Manlift Hazards

The operation of aerial lifts used to conduct activities such as surveying and decontaminating the tent pose a hazard due to personnel, equipment, and property. Control measures for the safe operation of aerial lifts include:

- aerial lifts will be inspected by RMRS Health and Safety prior to use;
- only trained and authorized individuals will be allowed to operate the aerial lift;
- the aerial lift will be inspected in accordance with HSP 22.06, *Work Platforms* prior to the beginning of each shift and an inspection checklist will be completed;
- prior to and during operations, the work area will be inspected for hazards such as holes, bumps, debris, obstructions, and high voltage conductors;
- a warning system will be established at least six feet from the excavation to prevent the manlift from falling into the excavation. A spotter will be positioned on the ground if necessary;
- before elevating the platform the operator shall:
  - check for overhead hazards
  - make sure the lift is on a firm and level surface;
  - make sure platform guardrails are properly installed and gates are closed and secure; and
  - check to see that all occupants have the proper fall arrest equipment and properly attached.
- before and while driving in the elevated position, the operator will maintain a clear view of the path to be traveled; and
- the operator shall ensure that the area surrounding the platform is clear of personnel and equipment prior to lowering the platform.

5.4.22 Class IIIa Laser Hazards

The Newport, Electronics Inc., Model OS521 handheld infrared thermometer used to obtain depleted uranium temperature measurements is equipped with a Class IIIa laser sight. Control measures for the safe operation of the laser sight include:

- The HSS or SSO who uses the laser sight will be the designated Laser Safety Officer and will be knowledgeable in and responsible for the safe use of the laser sight;
- personnel in the area of use will be instructed not to look into the beam; and

- signs will be posted in the area of use and will read "Caution - Do Not Stare Into Beam".

6.0 GENERAL HEALTH AND SAFETY REQUIREMENTS

All on-site employees are required to meet the medical and training requirements before beginning work at this site. Medical and training requirements for specific individuals will depend on the tasks to be performed and associated hazards or risks, and safety requirements.

6.1 MEDICAL SURVEILLANCE

All personnel assigned to field activities must participate in the RFETS Medical Surveillance Program in accordance with 29 CFR 1926.65 (f) *Medical Surveillance* and HSP Section 4.0, *Medical Program* with subsequent certification by an occupational physician for the following:

- physical fitness to perform intended work activities;
- the ability to perform hazardous waste and nuclear work;
- the ability to wear level B personal protective equipment including air-purifying and supplied air respirators; and
- the ability to work in thermally hot environments.

The RMRS Health and Safety Supervisor or designee will review medical documentation from the physician to ensure fitness for duty. Any restrictions will be noted and adhered to.

Starmet personnel assigned to field activities will participate in the Scientech Medical Surveillance program for hazardous waste workers, or an equivalent program, such as the S.M. Stoller Medical Surveillance program, which is consistent with the requirements contained in 29 CFR 1926.65(f), and is modeled on guidelines contained in the NIOSH/OSHA/USCG/EPA document, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. Information about specific site activities and job assignments will be provided to the examining physician so that field personnel can be evaluated for the above listed criteria. A copy of the physician's statement of fitness for duty relative to the anticipated duties of the employee, which shall also include any work restrictions, will be reviewed by the Starmet Lead HSS and Project Site Supervisor, and RFETS Occupational Health. All restrictions will be adhered to.

Radiation dosimeters and job specific bioassay testing will be furnished by RFETS External and Internal Dosimetry for personnel working on this project.

6.2 SAFETY TRAINING

Employees, including Starmet personnel, will not participate in field activities until they have been trained to a level required by their job function and responsibility. All training and field experience will be verified and records shall be maintained by the Site Safety Officer or designee. Training requirements are summarized in Table 6.1 and must be current. An "X" means the training is required.

Offsite training for Starmet employees will be accepted based on review and approval of the specific health and safety program by RMRS. Documentation of training, either RFETS or off-site, will be maintained on site by the Starmet HSS.

Because Starmet personnel will be wearing same Level B and Level C respiratory protection as RMRS, they will also be working under the RMRS respiratory program that will be implemented during the project.

Table 6.1
Safety Training Summary

Required Training	Contamination Area High Contamination Area (Exclusion Zone)	Radiological Buffer Area (Contamination Reduction Zone)	Project Support Zone
Aerial Lift Training (018-211-01)	X[1]	X[1]	X[1]
ConCover Machine Operations (NA)	X[1,2]	X[1,2]	X[1,2]
Fall Protection Safety Awareness (025-796-01)	X[1]	X[1]	X[1]
Fire Extinguisher Training (NA) ■ Dry Chemical and Met-L-X	X[1,2]	X[1,2]	X[1,2]
General Employee Radiation Training (019-278-01)			X
Hazard Communications (019-750-01)			X[3]
Hazard Com. Work Area Indoctrination (019-750-03)	X[2]	X[2]	X[2]
Haz-Mat Ops. For First Responders (062-471-01)	X[1]	X[1]	X[1]
Hearing Conservation (071-400-01)	X	X	
Hoist Apparatus Training (025-547-01)	X[1]	X[1]	X[1]
HSP-21.04 Briefing (NA)	X[2]	X[2]	X[2]
Incident Commander Training (021-370-01)	X[1]	X[1]	X[1]
Industrial Truck Safety Training (028-276-01)	X[1]	X[1]	X[1]
Ladder Safety Awareness (025-985-01)	X[1]	X[1]	X[1]
Lock Out/Tag Out Briefing (019-866-02)	X[1,2]	X[1,2]	X[1,2]
Medical Surveillance (056-86-15) ■ Respirator, negative pressure ■ Respirator, PremAire or SCBA ■ PPE clothing, Level B ■ Thermal Hot Environment Work ■ Hazardous Waste Work ■ Nuclear Work ■ Hearing Conservation	X	X	
OSHA 40 - Hour (018-691-19)	X	X	
OSHA 8 - Hour (018-691-05)	X	X	
OSHA Supervisor (018-691-01)	X[1]	X[1]	X[1]
OSHA 3 - Day On Site Supervision (018-691-07)	X[2]	X[2]	X[2]
Pre-Evolution Briefing (NA)	X[2]	X[2]	X[2]
Pressure Safety Awareness (025-914-01)		X[1]	X[1]
Radiation Worker II (023-484-00)	X	X	
Respirator Indoc. (056-284-01)	X	X	
Respirator Fit Chamber Certification (056-284-02)	X	X	
Respirator Protection Training-MSA 4500II (TBD)	X[2]	X[2]	
Respirator Protection Training-PremAire (012-931-01)	X[2]	X[2]	
Uranium Facilities Training	X[2]	X[2]	

[1] If job duties require
[2] Provided by RMRS
[3] Required for personnel who do not have OSHA 40 or 8 - Hour Hazardous Waste Operations Training

6.3 SITE SPECIFIC PRE-EVOLUTION BRIEFING

A site specific Pre-Evolution Briefing (Hazard Communication) will be conducted in accordance with Conduct of Operations Manual COOP-011 *Pre-Evolution Briefing* for all employees, including subcontractors, prior to commencement of field activities. The following topics will be discussed at this briefing:

- names of health and safety personnel and alternates responsible for site health and safety;
- health and safety organization;
- location of the approved Health and Safety Plan;
- first aid and medical facilities;
- hazards at the site including chemical, radiological, physical, and biological;
- medical surveillance requirements including recognition of symptoms and signs which may indicate exposure to hazards;
- location and review of MSDSs for all hazardous chemicals on site;
- exposure risk;
- personal protective equipment to be used;
- personnel and equipment decontamination procedures;
- air monitoring for radionuclides and chemicals of concern; and
- emergency procedures.

If an off site vendor is used to perform parts of this project, then the following items will also be discussed:

- employee rights and responsibilities and location of DOE form F5480.4, *Complaint Form*;
- general subcontractor, lower-tier subcontractor and/or vendor responsibilities;
- emergency response procedures including local warning and evacuation systems;
- specific occupational health and safety procedures applicable to the project;
- the Hazard Communications Program;
- employee access to exposure monitoring data and medical records;
- construction hazard recognition and the procedures for reporting or correcting unsafe conditions;
- procedures for reporting accidents or incidents;
- fire prevention and control;
- alcohol and drug abuse policy; and
- disciplinary actions for safety infractions and violations.

It is the employee's responsibility to ensure he/she is familiar with the HASP contents relating to their specific job tasks. If at anytime, an employee does not feel they understand the contents of the HASP,

another briefing shall be administered and/or they may request a current copy of the HASP from the Site Safety Officer. Once the briefing and/or review of the HASP is completed and employees understand the contents of the HASP, they will be required to sign the Safety Compliance Agreement form acknowledging they understand and agree to comply with this HASP.

If a new employee who has not gone through the Pre-Evolution briefing is assigned to the site, the SSO or designee must provide a similar briefing to the new employee before he or she participates in any field activities. New employees must sign the Safety Compliance Agreement form and meet the training requirements of Section 6.2 before beginning field work for this project.

6.4 DAILY/SHIFT HEALTH AND SAFETY MEETINGS

Daily/shift plan-of-the-day (POD) and safety briefings for site employees will be conducted. The briefings will address the day's planned activities, reminders of safety responsibilities, new chemicals brought on site, lessons learned, and any safety concerns. These meetings will be documented by the Site Safety Officer or designee.

6.5 ACCIDENT/INCIDENT REPORTING

All accidents, incidents, and near misses will be immediately reported to the Field Supervisor and the Project Manager. It is the Project Manager's responsibility to ensure that the appropriate personnel are notified of the accident/incident. In addition, RFETS requires Department of Energy (DOE) form 5484.X, "Individual Accident/Injury Report" to be completed for all first aid incidents and the following "Recordable" occupational injuries or illnesses as defined below. Starmet personnel shall report all accidents/incidents to the on-site Starmet Project Supervisor who will notify the RMRS Field Supervisor or Project Manager.

- **OCCUPATIONAL INJURY** is any injury such as a cut, fracture, sprain, or amputation that results from a work accident or from an exposure involving a single incident in the work environment that requires more than standard first aid.

  Note: Conditions resulting from animal or insect bites, or one-time exposure to chemicals, are considered to be injuries.

- **OCCUPATIONAL ILLNESS** of an employee is any abnormal condition or disorder, other than one resulting from an occupational injury, caused by exposure to environmental factors associated with employment. It includes acute and chronic illnesses or diseases that may be caused by inhalation, absorption, ingestion, or direct contact with a toxic material.

- **PROPERTY DAMAGE LOSSES** of $1,000 or more are reported as follows: Accidents that cause damage to DOE property, regardless of fault, or accident wherein DOE may be liable for damage to a second party, are reportable if damage is $1,000 or more. Include damage to facilities, inventories, equipment, and properly parked motor vehicles. Exclude damage resulting from a DOE-reportable vehicle accident.

- **GOVERNMENT MOTOR VEHICLE ACCIDENTS** resulting in damages of $250 or more, or involving injury, are reported unless the government vehicle is not at fault, damage of less than $250 is sustained by the government vehicle, and no injury is inflicted on the government vehicle occupants.

6.6 VISITOR CLEARANCES

Visitors to the Trench 1 site will be given a site specific briefing by the Field Operations Deputy Project or designee in accordance with Operations Order 00-T1-03 *Trench T-1 Visitor Orientation*. Prior to entering the site, visitors will also provide the Site Safety Officer with documentation of training required by Section 6.2. Visitors who do not provide documentation will not be allowed in areas of the site which require project specific training. Visitors without the training required in Section 6.2 shall be escorted in the project support zone by a trained individual.

6.7 HEALTH AND SAFETY LOGBOOKS

Separate health and safety logbooks with control numbers shall be maintained by Field Supervisors, SSOs, HSSs, and RCTs and will be turned in to the RMRS Project Manager once the project is completed. The Project Manager will then turn in the project logbooks and documents to the environmental records management group. Logged information will meet the requirements of procedure 2-S47-ER-ADM-05.14 *Use of Field Logbooks and Forms* which is base on the RFETS Conduct of Operations Manual and shall include: (1) observations; (2) health and safety issues and concerns; (3) types of monitoring conducted; (4) results of monitoring; (5) description of unforeseen hazards and steps taken to mitigate hazards; (6) safety infractions; (7) accidents and injuries; and (8) other significant health and safety items.

7.0 SITE-SPECIFIC HEALTH AND SAFETY REQUIREMENTS

7.1 SITE CONTROL

Site control is necessary to prevent unauthorized, untrained, or unprotected personnel or visitors from being exposed to the hazards associated with the site. Site control measures at the Trench 1 Site will include the following:

- erecting a fence around the east, south, and west sides of the site for the duration of the project;
- project personnel and visitors will enter the site through the east gate only;
- as described in Section 9.3, the Personnel Accountability Tag System will be utilized by all project personnel and visitors;
- visitors to the site shall be scheduled through the Field Operations Deputy Project Manager or designee prior to arrival;
- the Field Operations Deputy Project Manager or designee shall be notified of all visitors at the site;
- visitors to the site shall sign their name, time in, and time out on the visitor control log maintained by the Field Operations Deputy Project Manager or designee;
- posting signage or erecting barriers communicating information such as radiological hazards, required personal protective equipment, and work zone boundaries; and
- securing the site at the end of each shift.

7.2 WORK ZONES

The Trench 1 site will have several distinct work zones based on the radiological, chemical, and physical hazards associated with the project. Work zones will be clearly marked with rope, banner tape, fencing or other high visibility markings, and signs. The following is a list of work zones which will be posted at the site.

- "High Contamination Area" (HCA) - A majority of the inside the temporary structure will be posted as a HCA due to potential high levels of contamination. Major operational areas inside the HCA will include the excavation, the SIP, and the soil stockpile.
- "Contamination Area" (CA) - There will be several CAs within the temporary structure which will serve as transition areas to and from the HCA for personnel, waste containers, and equipment. The CA boundary will also be posted as an "Exclusion Zone" (EZ).
- "Radiological Buffer Area" (RBA) - At a minimum, RBAs will be established adjacent to the entry/exit points of the CAs. The RBA boundary will also be posted as a

"Contamination Reduction Zone" (CRZ). The RBA/CRZ is the corridor through which all personnel will enter and exit from the CA/EZ. The RBA/CRZ serves as a boundary to minimize the spread of contamination and to limit radiological doses to collocated workers and untrained personnel. RBA/CRZs contain "Step-off Pads" for personnel whole body radiological frisking and chemical decontamination.

- "Radioactive Material Area" (RMA) - RMAs will be posted around radioactive waste containers which will be stored outside of the temporary structure.
- "Step-off Pads" - Step-off pads will be located at exit points from the HCA and CAs and will be used in conjunction with doffing of outer and inner layers of PPE respectively and for radiological frisking of personnel.
- "Radiation Area" (RA), and "High Radiation Area" (HRA) - RAs and HRAs will be posted based on radiation survey results.
- The Project Support Zone (PSZ) contains personnel who perform support functions and provides a break area. Managers, support equipment, etc. are generally located in the project support zone. If contaminated, personnel and equipment exiting a RBA/CRZ must be decontaminated prior to entering the project support zone

NOTE: To ensure that the health and safety of collocated workers and the public is not in question, the boundaries and locations of the work zones are subject to change based on air sampling/monitoring results and potential exposure to chemical, radiological or safety hazards.

7.3 PERSONAL PROTECTIVE EQUIPMENT (PPE)

The purpose of personal protective equipment (PPE), including clothing, is to shield or isolate individuals from the chemical, radiological, physical and biological hazards that they may encounter at the Trench 1 site. The careful selection and use of PPE will protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing.

No single combination of protective equipment and clothing is capable of protecting against all hazards, and PPE must be used in conjunction with other protective measures. The use of PPE can in itself create significant worker hazards, such as heat stress, physical and psychological stress, and impaired vision, mobility, and communication.

Specific protective garments are selected on the basis of a variety of criteria. In general, the greater the hazard, the greater the level of PPE. For any given situation, equipment and clothing must be selected to provide an adequate level of protection. Over-protection as well as under-protection can be hazardous and should be avoided.

Supplied air respiratory protection will be worn in the HCA/EZ and CA/EZ (excluding in the vestibules) during the actual excavation of the trench due to the possibility of encountering unknowns and the presence of diesel combustion gases. It is anticipated that all personnel inside the temporary structure during excavation will wear SCBAs with the exception of heavy equipment operators and SIP personnel who will wear airline respirators. Level B respiratory protection will be used in accordance with Operations Order No. 00-T1-05 *Use of MSA Custom 4500II Self Contained Breathing Apparatus and PremAire™ Air Line System*. Full-face air-purifying respirators with HEPA cartridges may be worn when no excavating is taking place and real-time air monitoring indicates that no chemical or particulate action levels are being exceeded (See Table 7.2 for action levels).

Table 7.1 summarizes PPE requirements for specific tasks associated with operations at the Trench 1 site and the following sections detail the criteria for selecting specific PPE which will apply to this project. NOTE: The PPE shown in Table 7.1 are subject to change at the discretion of the Health and Safety Supervisor, Site Safety Officer, Radiological Engineer, Radiological Technical Safety Supervisor, and the Project Manager or designee.

Table 7.1
Personal Protective Equipment Summary

HIGH CONTAMINATION AREA WITHIN TEMPORARY STRUCTURE

Tasks	Level	Body[1]	Foot	Head	Eye[2]	Hand	Respirator[3]
• Excavation of drums, soil, debris, unknown material, and suspected classified items • Segregation of drums, soil, debris, unknown material, and suspected classified items • Transport of material to the Sampling and Inerting Pad (SIP) • Sampling and Inerting Pad (SIP) Operations • Transport of soil to the soil stockpile • Management of soil stockpile • Excavation Verification Sampling • Soil transport and backfill • Decontamination of Equipment or materials • Surveying equipment, materials, and soil • Conducting surveys for deposting of HCA	B or C	Inner and outer Anti-C coveralls	Hard toed safety shoes, two pair of shoe covers, and two pair rubber overshoes	Hood	None	Two pairs inner surgeon and one pair outer nitrile gloves (cotton liners optional). Heavy duty work gloves as necessary. Lead loaded gloves (30 mil equivalent Pb) will be worn by personnel who directly handle depleted uranium unless directed otherwise by Radiological Engineering.	Supplied air, SCBA or full-face air-purifying respirator with HEPA cartridges

[1] If splash hazards exists and cannot be mitigated, polycoated Anti-Cs or polycoated long sleeve aprons will be worn.
[2] No eye protection will be required when a full facepiece respirator is worn.
[3] Work may be conducted in Level C respiratory protection if continuous real-time air monitoring indicates no action levels are exceeded and no excavation is being conducted.

CONTAMINATION AREA WITHIN TEMPORARY STRUCTURE

Tasks	Level	Body[1]	Foot	Head	Eye[2]	Hand	Respirator[3]
• Surveying equipment, material, and soil • Soil transport and backfill • Decontamination of equipment or materials • Conducting surveys for deposting of CA • Other miscellaneous tasks	B or C	Anti-C coveralls	Hard toed safety shoes, shoe covers, and rubber overshoes	Hood	None	One pair inner surgeon and one pair outer nitrile gloves (cotton liners optional). Heavy duty work gloves as necessary	Supplied air, SCBA or full-face air-purifying respirator with HEPA cartridges

[1] If splash hazards exists and cannot be mitigated, polycoated Anti-Cs polycoated long sleeve aprons will be worn.
[2] No eye protection will be required when a full facepiece respirator is worn.
[3] Work may be conducted in Level C respiratory protection if continuous real-time air monitoring indicates no action levels are exceeded and no excavation is being conducted.

CONTAMINATION AREAS WITHIN VESTIBULES

Tasks	Level	Body[1]	Foot	Head	Eye[2]	Hand	Respirator[3]
• Frisking personnel at the HCA step-off pad • Surveying equipment and material • Decontamination of equipment or material • Conducting surveys for deposting of CA • Other miscellaneous tasks	C	Anti-C coveralls	Hard toed safety shoes, shoe covers, and rubber overshoes	Hood	None	One pair inner surgeon and one pair outer nitrile gloves (cotton liners optional). Heavy duty work gloves as necessary. When hands cross into the HCA/EZ for frisking activities, an additional pair of surgeons are required	Full-face air- purifying respirator with HEPA cartridges

[1] If splash hazards exists and cannot be mitigated, polycoated Anti-Cs polycoated long sleeve aprons will be worn.
[2] No eye protection will be required when a full facepiece respirator is worn.
[3] Depending on the results of chemical and particulate air monitoring, SCBA or supplied air respiratory protection may be required.

Table 7.1
Personal Protective Equipment Summary (cont.)

RADIOLOGICAL BUFFER AREAS							
Tasks	**Level**	**Body**	**Foot**	**Head**	**Eye**	**Hand**	**Respirator**
• Frisking personnel at the CA step-off pad • Surveying equipment and material • Other miscellaneous tasks	Modified D	Over the shoulder DOE coveralls	Hard toed safety shoes	None	Safety glasses with side shields	One pair inner surgeon if conducting radiological surveys (cotton liners optional). Heavy duty work gloves as necessary	None

SUPPORT ZONE AND WASTE CONTAINER STAGING AREA							
Tasks	**Level**	**Body**[1]	**Foot**	**Head**	**Eye**	**Hand**	**Respirator**
• Management of waste containers • Surveying equipment and material • Site reclamation • Other miscellaneous tasks	Modified D	Over the shoulder DOE coverall	Hard toed safety shoes	Hard hat	Safety glasses with side shields	Heavy duty work gloves as necessary. Surgeon gloves when surveying equipment and materials.	None

[1] or equivalent

7.3.1 Level D Personal Protective Equipment

The use of Level D personal protective equipment is defined by the following criteria:

- no contaminants are present, or contaminants are present below the action levels established in the HASP for respirator use; and
- work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals or radionuclides.

Level D is a field work uniform affording minimal skin protection and no respiratory protection. It consists of the following PPE:

- long pants and over the shoulder shirt or DOE issue coveralls;
- hard toe safety shoes (ANSI Z41.1 approved);
- heavy duty leather work gloves, when appropriate;
- safety glasses (ANSI Z87.1 approved) with side shields; and
- hard hat (ANSI Z89.1 approved).

Modified Level D personal protective equipment provides an increased level of skin protection and no respiratory protection. It may consists of the following PPE:

- hard toe safety shoes;
- heavy duty leather work gloves, when appropriate;
- safety glasses with side shields;
- hard hat;
- Anti-C coveralls;
- outer nitrile gloves or inner surgeon gloves; and
- disposable shoe covers.

7.3.2 Level C Personal Protective Equipment

The main selection criterion for Level C, as opposed to the less restrictive Level D, is that conditions require and permit wearing air-purifying respirators. A full-face, air-purifying respirator can be used only if all of the following conditions are met:

- oxygen concentrations are greater than 19.5 percent and less than 23.5 percent by volume;
- measured air concentrations of identified substances will be reduced by the respirator below the PEL or TLV;
- atmospheric contaminant concentrations do not exceed IDLH levels;

- continuous direct readings on monitoring instruments, such as FIDs or PIDs, are within the action levels prescribed in the HASP for air-purifying respirator use;
- the substance in question has adequate warning properties;
- the individual has taken the Respirator Indoctrination CBT class;
- the individual has passed a mask specific quantitative fit-test;
- the individual has medical clearance for the use of air-purifying respirators; and
- the appropriate cartridges are used and their manufacturers specified service limit concentration is not exceeded.

Level C personal protective equipment provides moderate skin and respiratory protection. It may consist of the following PPE:

- full-facepiece, air-purifying respirator with correct cartridges;
- hard toe safety shoes;
- hard hat; and
- appropriate clothing based on the radiological or chemical hazard.

7.3.3 Level B Personal Protective Equipment

In cases where air-purifying respirators do not provide adequate respiratory protection, Level B PPE will be worn. Criterion for selection of Level B PPE are as follows:

- the potential for exposure to unknown chemicals exists;
- measured air concentrations of identified substances will be reduced by the supplied air respirator or self contained breathing apparatus (SCBA) below the PEL or TLV;
- continuous direct readings on monitoring instruments, such as FIDs or PIDs, are within the action levels prescribed in the HASP for supplied air respirator use;
- the individual has taken the MSA 4500II and/or PremAire training classes;
- the individual has passed a mask specific quantitative fit-test; and
- the individual has medical clearance for the use of supplied air respirators.

Level B PPE provides moderate skin protection and the maximum respiratory protection. When working in a "Contamination Area" or when conducting "routine" work in the "High Contamination Area", Level B PPE may consist of the following:

- anti-C coveralls;
- cotton glove liners (optional);
- two pair inner surgeon and one pair outer nitrile gloves;
- shoe covers (two pair in a HCA);

- rubber overshoes (two pair in a HCA);
- hood;
- full-face air-purifying respirator with HEPA cartridges or full-facepiece supplied air respirator or SCBA;
- hard toe safety shoes;
- hard hat; and
- heavy duty leather gloves as needed.

When conducting "heavy" work in the "High Contamination Area", Level B PPE may consist of the following:

- two pairs of Anti-C coveralls;
- cotton glove liners (optional);
- two pairs of inner surgeon and one pair outer nitrile or lead loaded gloves;
- two pairs of shoe covers;
- two pairs rubber overshoes;
- hood;
- full-face air-purifying respirator with HEPA cartridges or full-facepiece supplied air respirator or SCBA;
- hard toe safety shoes;
- hard hat; and
- heavy duty leather gloves as needed.

7.3.4 Storage, Inspection, and Maintenance of PPE

Clothing and respirators must be properly stored to prevent damage and/or malfunction due to exposure to dust, sunlight, damaging chemicals, and impact. Proper storage of PPE and respirators will include the following:

- clothing and respirators will be stored in a dry, clean, uncontaminated area out of direct sunlight;
- clothing and respirators will not be stored in proximity to any chemicals such as gasoline;
- clothing will be stacked in orderly fashion so that no other objects or equipment are on top of them leading to tears, punctures, rips, or deformations;
- all SCBAs and airline respirators will be properly placed in their cases;
- all full-facepiece air-purifying respirators will be stored in clear plastic bags in a single layer with no other objects or equipment placed on top of them which could lead to deformation of the facepiece; and

- different types and materials of clothing should be clearly marked or stored separately to prevent issuing the wrong clothing by mistake.

Inspection of clothing and respirators (SCBAs, airline, and full-facepiece air-purifying) is imperative to ensure proper protection. It is the responsibility of each individual to thoroughly inspect all clothing and respirators prior to and during field activities. Inspection of clothing will include the following:

- visually inspecting for imperfect seams, non-uniform coatings, tears, and malfunctioning closures;
- holding clothing up to light and inspecting for pinholes;
- flexing the products to inspect for cracks and other signs of shelf deterioration;
- inspect gloves for pinholes by trapping air in them, sealing the gauntlet, and observing for air leakage;
- while in the field, periodically inspect for tears, punctures, and closure failures; and
- after use, inspect for signs of degradation, permeation, or other signs of deterioration.

Inspection of SCBAs and airline respirators will be performed prior to each use and will include:

- visually inspect the air cylinder, backpack, harnesses, high and low pressure hoses, and regulators;
- visually inspect the facepiece assembly;
- inspect all connections for proper tightness;
- conduct a leak test;
- conduct the audio alarm test; and
- conduct a unit function test in both normal operating mode and in the emergency bypass mode.

Inspection of full-facepiece air-purifying respirators will be performed prior to each use and will include:

- visually inspect the facepiece seal, lens, and harness;
- inspect the inhalation and exhalation valves;
- inspect cartridges for proper type and expiration date; and
- conduct both positive and negative pressure tests.

Maintenance of all PPE and SCBAs or airline respirators will be performed only by individuals having specialized training and equipment.

7.3.5 PPE Donning and Doffing Guidelines

The following guidelines are recommended when Level C PPE or higher is required for a task. No person shall be allowed to enter the HCA, CA/EZ, or RBA/CRZ if they are not wearing the appropriate PPE. Donning and doffing guidelines will be posted at the appropriate locations at the site.

Donning Guidelines

After inspecting airline respirators, SCBA systems, or full face respirators, the recommended sequence for donning a single set of PPE is as follows:

1. Shoe covers
2. Anti-C coveralls
3. Cotton glove liners (optional)
4. Inner surgeon gloves
5. Rubber overshoes
6. Outer surgeon gloves, tape to Anti-C coveralls
7. Outer nitrile gloves, tape to Anti-C coveralls
8. Skull cap (optional)
9. Respiratory protection
10. Connect airline respirator or SCBA and activate unit, if applicable
11. Close Anti-C coveralls
12. Hood, tape to facepiece
13. Thermoluminescent dosimeter (TLD)

After inspecting airline respirators, SCBA systems, or full face respirators, the recommended sequence for donning a double set of PPE is as follows

1. Inner shoe covers
2. Inner Anti-C coveralls
3. Cotton glove liners (optional)
4. Wrist dosimeter, if applicable
5. Inner surgeon gloves
6. Inner rubber overshoes
7. Outer surgeon gloves, tape to inner Anti-C coveralls
8. Skull cap (optional)
9. Outer Anti-C coveralls
10. Outer shoe covers
11. Outer rubber overshoes

12. Outer nitrile or lead loaded gloves, taped to outer Anti-C coveralls
13. Respiratory protection
14. Connect airline respirator or SCBA air supply and activate unit, if applicable
15. Close outer Anti-C coveralls
16. Hood, tape to facepiece
17. Thermoluminescent dosimeter (TLD)

Doffing Guidelines

It is encouraged that additional personnel be present at the step-off pads to assist workers in doffing their PPE. The recommended sequence for removing a single set of PPE at the "Contamination Area" step-off pad is as follows:

Caution

To prevent contamination of personnel, equipment, or clean areas during the doffing of PPE, it is important that personnel adhere to the posted doffing guidelines and RCT instructions

1. Remove exposed tape
2. Remove rubber overshoes
3. Remove outer nitrile gloves
4. Remove hood from front to rear
5. Remove respirator protection, as applicable
6. Remove Anti-C coveralls, inside out, touching inside only
7. Take down barrier closure as, applicable
8. Remove tape from shoe covers
9. Remove each shoe cover, placing shoe onto clean step-off pad as each is removed
10. Remove inner surgeon gloves and cotton liners if worn
11. Replace barrier closure, as applicable
12. Commence whole body frisking
13. Monitor badge and dosimeter
14. Clean and sanitize respirator after receiving radiological clearance from RCTs.

Disposable PPE will be discarded in the properly labeled container.

The recommended sequence for removing a double set of PPE at the "High Contamination Area" (HCA) and "Contamination Area" (CA) step-off pads is as follows.

Before stepping to the HCA step-off pad:

1. Remove exposed tape
2. Remove rubber overshoes
3. Remove outer nitrile or lead loaded gloves
4. Remove hood from front to rear
5. Remove outer Anti-C coveralls, inside out, touching inside only.
6. Remove tape from inner Anti-C coveralls and sleeves
7. Remove outer shoe covers, stepping to clean HCA step-off pad as each is removed
8. Commence whole body frisking, if required
9. Proceed to CA step-off pad

Before stepping to the CA step-off pad:

10. Remove outer surgeon gloves
11. Remove respiratory protection, as applicable
12. Remove inner Anti-C coveralls, inside out, touching inside only
13. Take down barrier closure, as applicable
14. Remove tape from inner shoe covers
15. Remove inner shoe covers, placing shoe onto clean outer step-off pad as each is removed
16. Remove inner surgeon gloves and cotton liners if worn
17. Replace barrier closure, as applicable
18. Commence whole body frisking
19. Monitor badge and dosimeter
20. Clean and sanitize respirator after receiving radiological clearance from RCTs.

Disposable PPE will be discarded in the properly labeled container.

7.4 MONITORING REQUIREMENTS

Monitoring of the environmental conditions in and around the temporary structure, including the SIP and the vestibules, must occur because of the potential for radiological and chemical contaminants to be present. The following sections describe the monitoring program to be implemented and appropriate action levels. Where feasible, personnel exposures to hazardous materials (other than radioactive substances) shall be maintained below the TLVs adopted by the ACGIH or the PELS adopted by OSHA, whichever is more stringent. Potential exposures to diesel combustion gases may exceed the PEL/TLV but will be

maintained below levels that are Immediately Dangerous to Life and Health (IDLH). To ensure that personnel are not exposed to IDLH levels of diesel combustion gases in the temporary structure, continuous real-time air monitoring will be conducted for carbon monoxide, nitrogen dioxide, and sulfur dioxide and the temporary structure ventilation system will be active when diesel powered heavy equipment is operating.

Exposure to radioactive material will be maintained as low as reasonably achievable (ALARA) and below the RFETS administrative control limit of 750 mrem. In addition, RMRS has budgeted 231 mrem for the project for the calendar year 1998 ALARA goal. Table 7.2 presents a summary of the monitoring program including radiological suspension guide limits and administrative limits, and industrial hygiene action levels.

Particular attention will be payed to personnel not wearing respiratory protection in the RBA/CRZs who are located in the temporary structure vestibules. Although the temporary structure is not a containment, the ventilation system on the temporary structure is designed to provide approximately four air changes per hour and is anticipated to maintain a negative pressure through the vestibules. Prior to excavation operations, airflow within the vestibules will be evaluated to confirm that chemical contaminants such as diesel combustion gases do not build up in the vestibules.

Table 7.2
Monitoring Program Summary

RADIOLOGICAL SUSPENSION GUIDE LIMITS			
Hazard	**Suspension Guide Limit/Hold Point**	**Action(s) to be Taken**	**Monitoring/Sampling Frequency**
Equipment or material radiological contamination in "HCA"	Alpha contamination: 200,000 dpm/100cm^2 removable Beta/gamma contamination: 400,000 dpm/100cm^2 removable	Suspend operations, secure area and notify the Field Supervisor and Radiological Safety Technical Supervisor (RSTS)	Daily contamination control surveys within the "High Contamination Area".
Equipment and material radiological contamination in "CA"	Alpha contamination: 50,000 dpm/100cm^2 removable 500,000 dpm/100cm^2 total Beta/gamma contamination: 100,000 dpm/100cm^2 removable 500,000 dpm/100cm^2 total[1]	Suspend operations, secure area and notify the Field Supervisor and RSTS.	Daily contamination control surveys within the "Contamination Area".
Equipment and material radiological contamination in "RBA" or areas not controlled for radiological purposes	Alpha contamination: 1,000 dpm/100cm^2 removable 5,000 dpm/100cm^2 total Beta/gamma contamination: 1,000 dpm/100cm^2 removable 5,000 dpm/100cm^2 total[1]	Suspend operations, secure area and notify the Field Supervisor and RSTS.	Daily contamination control surveys within the "Radiological Buffer Area".
Personnel contamination.	> MDC[2] of instrument	Suspend operations, secure area and notify the Field Supervisor and RSTS.	Prior to exiting a "Contamination Area"
Airborne radioactivity	10 DAC[3] (U^{238} Class Y) when supplied air or full-facepiece air- purifying respirators are worn 0.10 DAC (U^{238} Class Y) when no respiratory is worn	Remove personnel from effected area, suspend operations, secure area and notify the Field Supervisor and RSTS.	Per the Radiological Work Permit and the ALARA Job Review
Beta/Gamma radiation in "HCA" or "CA"	10 mrad/hr gamma at 30 centimeters 300 mrad/hr beta on contact	Suspend operations, secure area and notify the Field Supervisor and RSTS. Performed neutron survey if > 10 mrad/hr gamma at 30 centimeters	Shiftly to characterize excavated material, waste packages, and work areas
Presence of total Pu or U^{235} as determined by gamma/alpha spec analysis	15 grams fissile U per pkgd container 3,960 grams enriched U per pkgd container 100 nCi/g Pu concentration 1 gram total Pu (WG Pu) per pkgd container	Suspend operations, secure area and notify Nuclear Safety and Criticality Safety.	Per the RMRS and Starmet SAPs

[1] Due to beta/gamma radiation penetrating the walls of waste packages, these limits for direct total beta/gamma may not be applicable.
[2] MDC - Minimum Detectable Counts
[3] DAC - Derived Air Concentration

Table 7.2
Monitoring Program Summary (cont.)

RADIOLOGICAL ADMINISTRATIVE LIMITS			
Hazard	**Action Level**	**Action(s) to be Taken**	**Monitoring/Sampling Frequency**
Releasing equipment or material from the "HCA" to the "CA" with contamination above "CA" limits	Alpha contamination: 50,000 dpm/100cm^2 removable 500,000 dpm/100cm^2 total. Beta/gamma contamination: 100,000 dpm/100cm^2 removable 500,000 dpm/100cm^2 total[1]	Equipment or material may not exit "High Contamination Area". Decontaminate or dispose of as waste	Prior to removal of equipment or material from the "HCA" to a "CA"
Releasing equipment or material from a "CA" with contamination above unrestricted release limits	Alpha contamination: 1,000 dpm/100cm^2 removable 5,000 dpm/100cm^2 total Beta/gamma contamination: 1,000 dpm/100cm^2 removable 5,000 dpm/100cm^2 total[1]	Equipment or material may not exit "Contamination Area". Decontaminate or dispose of as waste.	Prior to removal of equipment or material from a "Contamination Area" to an area not controlled for radiological purposes
Suspected presence of Pu^{239} or U^{235} as determined by Electra alpha/beta ratios	Alpha/Beta ratio > 1:2	Notify the Field Supervisor and Radiological Safety Technical Supervisor. Contain material if possible. Analyze with AP-2. If AP-2 is inconclusive, conduct analysis by gamma/alpha spectroscopy.	Daily contamination control surveys
Airborne radioactivity	>0.10 DAC (U^{238} Class Y)	Notify the Field Supervisor and Radiological Safety Technical Supervisor. Post area as "Airborne Radioactivity Area"	Per the Radiological Work Permit and the ALARA Job Review
Gamma radiation in "HCA" or "CA"	>2 mrad/hr general area dose rate	Notify the Field Supervisor and Radiological Safety Technical Supervisor. Locate and if possible control the source.	Shiftly to characterize excavated material, waste packages, and work areas
	>5 mrad/hr at 30 centimeters	Notify the Field Supervisor and Radiological Safety Technical Supervisor. Post area as a "Radiation Area"	
Gamma radiation at "RBA" boundary	>50 μrem/hr	Notify the Field Supervisor and Radiological Safety Technical Supervisor. Adjust boundary until levels are <50 μrem/hr	Weekly or as required to characterize the "RBA" boundary
Presence of Pu^{239} in soil as determined by gamma/alpha spec analysis	≥8,475 pCi/g in any soil sample	Notify Air Quality Management	Per the RMRS and Starmet SAPs

[1] Due to beta/gamma radiation penetrating the walls of waste packages, these limits for direct total beta/gamma may not be applicable.

Table 7.2
Monitoring Program Summary (cont.)

CHEMICAL				
Hazard	**Action Level[1]**	**Action Level[2]**	**Action Level[3]**	**Monitoring Frequency**
Volatile organic compounds	NA	> Background	150 ppm	Continuous in the temporary structure and as needed to characterize RBA/CRZ and PSZ.
Carbon Monoxide	<12.5 ppm	12.5 ppm	1,200 ppm	
Hydrogen Cyanide	<2 ppm	2 ppm	50 ppm	As needed to characterize work areas.
Nitric Oxide	<12.5 ppm	12.5 ppm	100 ppm	As needed to characterize work areas.
Nitrogen Dioxide	<1.5 ppm	1.5 ppm	20 ppm	Continuous in the temporary structure and as needed to characterize RBA/CRZ and PSZ
Sulfur Dioxide	<1.0 ppm	1.0 ppm	100 ppm	

[1] Levels at which full face air-purifying respirators with HEPA cartridges may be worn
[2] Levels at which SCBAs or supplied air respirators must be worn.
[3] Levels at which work must be suspended - Immediately Dangerous to Life and Health (IDLH)

NOISE			
Hazard	**Action Level**	**Action(s) to be Taken**	**Monitoring Frequency**
Short term high noise levels	>85 dBA	Don suitable hearing protection, initiate noise dosimetry, and post area	As needed to characterize new equipment/operations and confirm adequacy of hearing protection
Continuous high noise levels	>85dBA average over 8-hour shift	Don suitable hearing protection. Employee participation in a Hearing Conservation Program required	As needed to characterize new equipment/operations and confirm adequacy of hearing protection

Table 7.2
Monitoring Program Summary (cont.)

PARTICULATES				
Hazard	**Action Level[1]**	**Action Level[2]**	**Action Level[3]**	**Monitoring Frequency**
Arsenic	.005 mg/m^3	0.5 mg/m^3	5 mg/m^3	Action levels for arsenic, beryllium, cadmium, and copper will be evaluated based on personal or area integrated air sampling rather than real-time particulate monitoring.
Beryllium	.0005 mg/m^3	.10 mg/m^3	4 mg/m^3	
Cadmium	.001 mg/m^3 (resp)	.1 mg/m^3 (resp)	9 mg/m^3	
Copper	.5 mg/m^3	50 mg/m^3	100 mg/m^3	
Cyanide	2.5 mg/m^3	May be worn up to IDLH level	25 mg/m^3	Continuous during dust generating activities.
Graphite	1.0 mg/m^3	100 mg/m^3	1250 mg/m^3	
Nuisance dust	1.5 mg/m^3 (resp)	150 mg/m^3 (resp)	Not Determined	
Uranium	.025 mg/m^3	2.5 mg/m^3	10 mg/m^3	The action level for uranium will be evaluated based on personal or area integrated air sampling rather than real-time particulate monitoring.

[1] Levels at which full face air-purifying respirators with HEPA cartridges must be worn
[2] Levels at which SCBAs or supplied air respirators must be worn.
[3] Levels at which work must be suspended - Immediately Dangerous to Life and Health (IDLH)

HEAT STRESS			
Hazard	**Action Level**	**Action(s) to be Taken**	**Monitoring Frequency**
Heat stress	Varies depending on work load and if PPE is worn.[1]	Work-rest regimen, ice vests, or other RMRS approved measures.	Varies depending on work load and PPE worn.[1]

[1] Wet bulb globe temperature monitoring will be performed during all field activities and the American Conference of Governmental Industrial Hygienists administrative guidelines will be followed (See Appendix C). In addition, physiological monitoring will be conducted in accordance with the methodology found in Section 7.4.3.4.

Table 7.2
Monitoring Program Summary (cont.)

COLD STRESS			
Hazard	**Action Level**	**Action(s) to be Taken**	**Monitoring Frequency**
Cold stress	40°F Equivalent chill temperature[1]	Wear adequate insulated dry clothing	Continuous when the equivalent chill temperature is <40°F
Cold stress aggravated by the use of evaporative liquids such as gasoline	39.2°F Equivalent chill temperature	Avoid soaking clothing or gloves with evaporative liquids	Continuous when the equivalent chill temperature is <40°F
Cold stress	19.4°F Equivalent chill temperature	Work-warm regimen will be instituted[2]	Continuous when the equivalent chill temperature is <40°F

[1] Equivalent chill temperature is the combined effect of the air temperature and wind speed. See Appendix C for ACGIH table used to calculate equivalent chill temperature.
[2] See Appendix C for ACGIH work-warm regimen schedule

EXPLOSIVE, OXYGEN DEFICIENT/ENRICHED ATMOSPHERES			
Hazard	**Action Level**	**Action(s) to be Taken**	**Monitoring Frequency**
Hydrogen (Explosion)	>10% of lower explosive limit	Suspend operations and notify the Field Supervisor	During the venting of drums and at the discretion of the SSO and HSS
Oxygen Deficient Atmosphere	< 19.5% oxygen or >23.5 % oxygen	Suspend operations and notify the Field Supervisor	Continuous inside the enclosure during work activities.

Table 7.2
Monitoring Program Summary (cont.)

WIND SPEED			
Hazard	**Action Level**	**Action(s) to be Taken**	**Monitoring Frequency**
Contamination dispersion	> 15 mph average for two consecutive 15 minute periods.	At the discretion of the Project Manager and the Site Safety Officer.	Continuous during all field activities.
Contamination dispersion and personal injury	> 30 mph average for two consecutive 15 minute periods. (Strong Wind Warning)	Terminate dust generating activities. Secure all outdoor material. Evaluate work on roofs and elevated surfaces. Work inside tent may proceed.	Continuous during all field activities.
Contamination dispersion and personal injury	> 45 mph average for two consecutive 15 minute periods. (Gale Warning)	Evaluate work outdoors and inside the tent.	Continuous during all field activities.
Contamination dispersion and personal injury	> 55 mph average for two consecutive 15 minute periods. (Whole Gale Warning)	Suspend work in the tent and evacuate personnel. Suspend all outdoor work except emergency activities.	Continuous during all field activities.

DEPLETED URANIUM TEMPERATURE MEASUREMENTS			
Hazard	**Action Level**	**Action(s) to be Taken**	**Monitoring Frequency**
Ignition of depleted uranium in drums or soil	10°F over initial baseline temperature	Suspend excavation of additional material. and obtain continuous temperature measurements of drums or soil	Every 15 minutes upon excavation. Continuous after 10°F change in temperature
	15°F over initial baseline temperature	Place water or sand in drum. Spread soil over large area.	Continuous
	25°F over initial baseline temperature	Flood drum with water. Cover material with sand or soil. Flood sand or soil with water.	Continuous
Ignition of mineral oil during inerting due elevated depleted uranium temperatures	25°F over initial baseline temperature	Cover material with sand or soil. Flood sand or soil with mineral oil.	Just prior to inerting.

7.4.1 VOC Monitoring

Air monitoring for VOCs will be conducted using a Foxboro, Inc., Model TVA-1000, which uses both a photoionization detector (PID) and a flame ionization detector (FID) to measure airborne concentrations of VOCs and SVOCs. The PID is equipped with a 10.6eV lamp and has a range of 0-2,000 ppm and the FID has a range of 0-50,000 ppm. Both the PID and FID will be calibrated daily prior to use and a yearly factory calibration and service is recommended. Daily calibrations will be per the manufacturers specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. The lamp, probe, and filters will be cleaned and/or replaced periodically. When measuring mixtures of volatile organic compounds, PID/FID devices are used as a screening instrument and cannot identify and quantify specific volatile organic compounds within the mixture. Due to the variable response of the PID/FID to different compounds, and the inability to identify the specific compound within the mixture, any reading above background will be the action level unless the compound of concern and the PID/FID response factors are known.

Air monitoring for VOCs using the FID and PID will be conducted in the breathing zone of the workers to assess potential chemical exposure to the worker and to evaluate the appropriateness of the level of protection worn by the worker. The Starmet HSS will be responsible for conducting real-time VOC monitoring in the SIP. Excavated material will also be screened for VOCs using the FID and/or PID.

Monitoring to evaluate exposure of Starmet personnel to VOCs may also be conducted using passive samplers such as the 3M 3500 Organic Vapor Monitor. This will allow for screening of the levels of, and the specific VOCs, to which personnel are exposed. Based on passive sampler results and direct reading instruments, additional methods for evaluating exposure to VOCs and other chemical contaminants, will be employed. These methods will include the NIOSH methods described in Table 7.3, however additional NIOSH methods may also be used, depending on the contaminants being evaluated. The SIP HSS personnel will work with the RMRS HSS personnel to ensure thorough and appropriate monitoring of all chemical and physical hazards of concern.

7.4.2 Radiological Monitoring

The radiation exposure of an occupational worker will be maintained as far below the U.S. Department of Energy (DOE) limits as is reasonably achievable (ALARA). A local annual administrative dose equivalent level of 750 mrem committed effective dose equivalent is in effect. To ensure that radiological exposures are maintained as low as reasonably achievable (ALARA), personnel, soil, and equipment may be monitored using a variety of techniques which are discussed in the following sections.

Based on historical process knowledge, the radiological isotope of concern is Uranium^{238}. Therefore, RCTs should observe an alpha/beta ratio of approximately 1:2 when conducting contamination control

surveys and when analyzing radiological swipes and air samples. If RCTs observe an alpha/beta ratio 1:2, it may a indication of the presence of Plutonium or fissile/enriched Uranium and the following actions should be taken:

- take additional readings;
- if the alpha/beta ratio continues to be $>1:2$, contain the material or item, if possible;
- notify the Field Operations Deputy Project Manager or designee and the Field Supervisor
- notify Radiological Safety Technical Supervisor;
- analyze the material, swipe, or filter with a Science Applications International Corp., Model AP-2 portable alpha analyzer;
- if the AP-2 analysis is inconclusive, conduct gamma/alpha spectroscopy analysis of the material, swipe or filter; and
- if gamma/alpha spectroscopy is positive for Plutonium or fissile/enriched Uranium, proceed to Section 7.7.5.

7.4.2.1 Personnel and Equipment Monitoring

Personnel leaving the HCA/EZ and CA/EZ will enter the RBA/CRZ where they will be frisked by RCTs for radioactive contamination. If personnel contamination is detected, the actions in section 7.7.4 should be followed.

After any necessary decontamination, all equipment and materials leaving the HCA/EZ and CA/EZ will be surveyed by RCTs in accordance with ROI-3.01, *Performance of Surface Contamination Surveys* and ROI-3.02, *Radiological Requirements for Uncontrolled Release.*

Instrumentation to be used for personnel and equipment contamination monitoring are those recommended by RFETS Radiological Engineering and consist of the following:

- NE Technology, Model Electra, with dual alpha/beta probe;
- Eberline, Model SAC-4, alpha smear counter;
- Eberline, Model BC-4, beta/gamma smear counter;
- Ludlum, Model 2929, dual alpha/beta smear counter;
- Ludlum, Model 12-1A, with air proportional alpha probe;
- Ludlum, Model 31 with 44-9 beta/gamma probe
- Science Applications International Corp., Model AP-2, portable alpha analyzer; and
- Oxford Instruments Inc, Model Series 5 XLB, dual alpha/beta automatic low background analyzer.

Any alternate instruments will be approved by RFETS Radiological Engineering. The Electra, SAC-4, BC-4, 2929, 12-1A, and 31 will be maintained, calibrated, performance tested, and used in accordance with RSP-2.01 *Radiological Instrumentation*. Use of the AP-2 will be accordance with RSP-3.02 *AP-2 Alpha Analyzer*.

The Series 5 XLB will be operated in accordance with RSP-3.01 *Performance Check and Operation of Tennelec Gas Proportional Alpha/Beta Detector Systems.*

7.4.2.2 Soil Monitoring

During excavation, and site reclamation, monitoring of the soil will be required. Monitoring of the soil will be conducted using a Bicron, Corp., Model Analyst equipped with a G5 probe which is a field instrument for detecting low energy radiation (FIDLER). The FIDLER will be maintained, calibrated, and used in accordance with RSP-2.01 *Radiological Instrumentation.*

7.4.2.3 Radioactive Air Particulate Monitoring

High and low volume air sampling will be conducted inside the temporary structure to evaluate work controls and characterize potential exposures to airborne Uranium^{238}. High volume air monitoring will be accomplished using Staplex Company, Inc., Model TFIA, high volume air samplers. Low volume air monitoring will be accomplished using Radeco, Model HD-66A, or Gast, Model RV23-14CV low volume air samplers.

Alternate high and low volume air samplers will be approved by RFETS Radiological Engineering. High and low volume air samplers will be maintained, calibrated, and used in accordance with RSP-4.02 *Air Sampling*.

In order to protect workers not wearing respiratory protection in the RBA/CRZs, to facilitate safe entry into the vestibules at the beginning of a work shift, and to prevent the spread of contamination to the outside environment, Continuous Air Monitors (CAMs) will also be operated. Rather than place the CAMs in the RBA/CRZ, the CAMs will be located in the CA/EZ at the interface of the vestibules and the main HCA/EZ area of the tent. Placing the CAMs closer to the potential source of airborne radioactivity will provide early warning of increasing levels of airborne radioactivity in the RBA/CRZ.

CAM operations will be accomplished using Scientific Applications International Corp., Model 452, Alpha Continuous Air Monitors which will be operated and maintained in accordance with RSP-4.01 *Continuos Air Monitor - Use.*

Ambient air monitoring outside of the temporary structure will be conducted for the purpose of tracking compliance with the public exposure standard specified in Title 40 CFR 61. The ambient monitoring will be conducted in accordance with the Kaiser-Hill *Trench 1 Source Removal Air Monitoring Plan* which calls for the use of the existing Radioactive Ambient Air Monitoring Program (RAAMP) sampling network. In order to directly characterize the radionuclide emissions generated from activities conducted within the temporary shelter, three high volume particulate samplers will be located near those activities that have the greatest potential to release radionuclides into the atmosphere. Use of the samplers will be in accordance with Operations Order No. 00-T1-08 *Ambient Air Monitoring Within the Trench 1 (IHSS 108) Source Removal Project Temporary Structure.*

7.4.2.4 External Radiation Monitoring

External radiation monitoring will be conducted with an Eberline, Model RO-20 portable ion chamber, or equivalent, capable of detecting beta, gamma, and x-ray radiation. A Bicron, Corp., μR Meter will be used to evaluate radiation levels at the boundary of the RBA. A Ludlum, Model 12-4, or equivalent, will be used to perform neutron surveys on items which exhibit gamma radiation readings > 10 mrad/hr at 30 centimeters. The 12-4 will also be used to survey waste packages. The RO-20, μR Meter, and 12-4 will be maintained, calibrated, and used in accordance with RSP-2.01 *Radiological Instrumentation.*

In addition to the real-time instrumentation mentioned above, employees who will work within the HCA/EZ or CA/EZ will be issued thermoluminescent dosimeters. Personnel who will directly handle depleted uranium, such as SIP personnel when sampling, will also be issued extremity dosimeters at the onset of the project. After review of the wrist dosimeter data, and at the discretion of the Radiological Engineer, the need for wrist dosimeters will be evaluated. Because the quarterly analysis of personal whole body thermoluminescent dosimeters may not be frequent enough to track personnel radiation doses and the dosimeters may contain doses obtained at locations other than Trench 1, Siemens Environmental Systems Ltd., Model Mark 1.2 alarming Electronic Personal Dosimeters (EPDs) will be issued to selected personnel as determined by Radiological Engineering. The EPDs will track personnel exposures on a daily basis and will alarm at area radiation dose rates greater than 2mrad/hr.

The need for dosimeters in the RBA/CRZ will be evaluated by Radiological Engineering. Dosimeters will be issued, worn, stored and processed in accordance with HSP-18.07, *External Radiation Dosimetry.*

7.4.2.5 Internal Radiation Monitoring

Employees who are issued dosimeter badges will be required to participate in the project specific bioassay monitoring program. All bioassay samples will be collected and analyzed in accordance with HSP-18.20, *Routine Bioassay Monitoring Program.* Additional urine and/or fecal bioassay samples may be required as determined by RFETS Radiological Engineering.

7.4.3 Miscellaneous Monitoring

In addition to VOC and radiological monitoring, numerous other potential hazards exist which require the use of real-time monitoring instruments. These hazards include noise, particulates, wind speed, heat and cold stress, explosive/oxygen deficient atmospheres, diesel combustion gases, and hydrogen cyanide.

Additional monitoring may be performed and equivalent instruments may be substituted at the discretion of the Site Safety Officer and the Health and Safety Supervisor.

7.4.3.1 Noise Monitoring

Noise levels will be monitored to delineate areas or activities where hearing protection is required, the effectiveness of hearing protection required, and whether or not personnel need to participate in a Hearing Conservation Program. The instrument used will be an Ametek, Model MK-3, audio dosimeter. The MK-3 is a microprocessor controlled personal monitor that measures noise exposure in the dBA range and displays a variety of results including real-time dBA level, exposure time, exposure dose, average dBA level, maximum dBA level, and the 8-hour time weighted exposure dose. The MK-3 is calibrated on a daily basis before and after use. Daily calibrations will be per the manufacturer's specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. Real-time noise monitoring results will be recorded on the Daily Industrial Hygiene Monitoring Log. Annual calibration and service of the instrument and the calibrator is required.

7.4.3.2 Particulate Monitoring

Particulate monitoring will be accomplished using a Monitoring Instruments for the Environment, Inc., Model PDM-3, Miniature Real-time Aerosol Monitor (miniram). The miniram is an airborne particulate monitor whose operating principle is based on the scattered electromagnetic radiation in the near infrared. The miniram continuously senses the particles in the sensing chamber and displays the particulate levels in mg/m^3. Because the miniram is preferential to particles 0.1 to 10 micrometers in size, it is useful in determining the levels of not only respirable particulates but fumes, smokes, and fogs. The instrument will be zero calibrated using a dust free Z-Bag prior to each use and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. Periodic cleaning of the sensing chamber is required. A yearly factory calibration and servicing is recommended. Monitoring will be conducted during all dust generating activities and results will be recorded on the Daily Industrial Hygiene Monitoring Log.

7.4.3.3 Wind Speed Monitoring

Wind speed will be monitored continuously throughout all phases of the project to ensure compliance with FO.01, *Air Monitoring and Dust Control*. This will be done by the use of a weather station equipped with

a R.M. Young Co., Model 05103 Wind Speed Monitor. The monitor is calibrated semi-annually.

A Davis Instruments, Corp., Model Turbo Meter, handheld electronic wind speed monitor may also be used. The Turbo Meter uses a turbine which is suspended on sapphire jewel bearings. The turbine rotation is sensed by an infrared light beam whose signal is processed by a large scale integrated circuit. The Turbo Meter is factory calibrated and requires no maintenance except minor cleaning.

7.4.3.4 Heat Stress Monitoring

Heat stress monitoring will be completed using a Imaging and Sensing Technology, Model RSS 214, Heat Stress Monitor. The instrument is a micro-processor based Wet Bulb Globe Thermometer (WBGT) which accurately measures environmental factors which contribute to heat stress. The WBGT reading displayed by the instrument, in either Fahrenheit or Celsius, is a weighted sum of the dry bulb, wet bulb, and vernon globe temperatures. The WBGT is factory calibrated on an annual basis. Maintenance is minimal with only the wet bulb wick requiring periodic replacement. Monitoring frequency will depend on the work area temperature, the type of work being performed, and the type of PPE worn. See Appendix C for guidance and action levels for work involving the use of personal protective equipment. Readings in the field will be logged on the Daily WBGT Log.

In addition to WBGT monitoring, physiological heat stress monitoring will be performed in accordance with the NIOSH/OSHA/USCG/EPA, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* as follows:

- Heart Rate Monitoring - The SSO or HSS will count the radial pulse of personnel exiting the Contamination Area or High Contamination Area as early as possible after exiting the Radiological Buffer Area. If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate exceeds 110 beats per minute at the beginning of the next rest period, shorten the next work cycle by one-third.
- Oral Temperature - Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the beginning of the rest period before drinking. If oral temperature exceeds 99.6°F, shorten the next work cycle by one-third and keep the rest period the same. If the oral temperature still exceeds 99.6°F at the beginning of the next rest period, shorten the next work cycle by one-third.
  NOTE: Personnel will not be allowed to wear semipermeable or impermeable coveralls when his/her oral temperature exceeds 100.6°F.
- Since it is not possible to monitor the heart rate and/or oral temperature of all personnel exiting the Contamination Areas or High Contamination Area, monitoring will be

conducted on personnel based on worst case work load, PPE worn, and other physiological factors.

7.4.3.5 Cold Stress Monitoring

Cold stress monitoring will be accomplished by obtaining the air temperature and the wind speed and calculating the equivalent chill temperature using the ACGIH guidelines found in Appendix C. When in the field, wind speed, temperature, and equivalent chill temperature will be logged on the Daily Wind Speed/Cold Stress Log.

7.4.3.6 Explosive, Oxygen Deficient/Enriched Monitoring

Air monitoring for explosive and oxygen deficient/enriched atmospheres will be conducted using a Mine Safety Appliances, Co., Model Passport. The Passport detects the concentration of explosive gases utilizing a catalyzed detector pelement and displays the results in percent (0-100) of the lower explosive limit. Because the Passport cannot be directly calibrated to a hydrogen standard, actual explosive levels of hydrogen will be calculated based on the conversion factor supplied by MSA. The passport also detects oxygen content with a range of 0-25%. The Passport is calibrated daily prior to use and requires factory calibration and service on a yearly basis. Daily calibration will be per the manufacturer's specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. Monitoring will be conducted in the temporary structure during the venting of drums and in the head space of drums as they are removed from the trench. Should monitoring results indicate levels >10% of the Lower Explosive Limit (LEL), all operations including the use of hand tools and other potential spark producing activities will be immediately suspended until levels drop below 10% of the LEL. Monitoring results will be recorded on the Daily Industrial Hygiene Monitoring Log.

7.4.3.7 Diesel Combustion Gases Monitoring

Monitoring for diesel combustion gases will be done using a Mine Safety Appliances, Co., Model Passport equipped with carbon monoxide, nitrogen dioxide, and sulfur dioxide sensors. The Passport simultaneously displays real-time gas levels in the following ranges; carbon monoxide 0-1000 ppm, nitrogen dioxide 0-20 ppm, and sulfur dioxide 0-20 ppm. The Passport is calibrated daily prior to use andrequires factory calibration and service on a yearly basis. Daily calibration will be per the manufacturer's specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. Monitoring will be conducted when diesel powered heavy equipment is operating.

Monitoring for nitric oxide will be accomplished using a Sensidyne Inc. Gas Sampling System equipped with nitric oxide colorimetric tubes. The tubes have a range of 2.5-200 parts-per-million. Monitoring will be conducted as needed to characterize levels inside the temporary structure. The hand held sampling

pump is leak tested daily prior to use. Monitoring results will be recorded on the Daily Industrial Hygiene Monitoring Log.

7.4.3.8 Hydrogen Cyanide Monitoring

Monitoring for hydrogen cyanide will be accomplished using a Sensidyne Inc. Gas Sampling System equipped with hydrogen cyanide colorimetric tubes. The tubes have a range of 2.0 - 50 parts-per-million. The hand held sampling pump is leak tested daily prior to use and monitoring results will be recorded on the Daily Industrial Hygiene Monitoring Log.

7.4.3.9 Depleted Uranium Temperature Monitoring

Temperature measurements of depleted uranium in drums or soil will be obtained to provide an indication of rapid oxidation which may lead to the ignition of the depleted uranium. In addition, temperature measurements will be obtained by the Starmet HSS just prior to inerting to verify that the depleted uranium is not undergoing a thermal reaction which could ignite the mineral oil. Measurements will be obtained using a Newport Electronics Inc., Model OS521 handheld infrared thermometer in accordance with Operations Order No. 00-T1-09 *Temperature Measurements of Depleted Uranium Using Infrared Heat Gun*

7.4.4 Personal and Area Integrated Air Sampling

In addition to real-time monitoring, personal and area integrated air sampling will be conducted, at the discretion of the Health and Safety Supervisor, at the excavation, the SIP, and the soil stockpile for VOCs, metals, cyanides, diesel emission gases, and dust. Job functions or work areas in the HCA/EZ and CA/EZ will be observed in order to sample the highest risk employees or areas. Samples will be obtained using Mine Safety Appliances, Co., Model Escort Elf and SKC, Model 224-PCXR4, personal sampling pumps. The pumps will be calibrated before and after sampling using a BIOS International, DC-1 primary gas flow calibrator. Daily calibration will be per the manufacturers specifications and results will be entered in the Industrial Hygiene Instrumentation Calibration Logbook. The BIOS DC-1 is a National Institute of Science and Technology (NIST) traceable calibrator which is certified on a yearly basis by the manufacturer. All samples will be obtained in accordance with the procedures contained in the NIOSH Manual of Analytical Methods. Samples will be analyzed by an American Industrial Hygiene Association (AIHA) accredited laboratory. Table 7.3 is a list of the analytes to be sampled and the methods to be used. At the onset of the project all analytes will be sampled for on a daily basis. After review of the personal and/or area integrated sampling results, and at the discretion of the Health and Safety Supervisor (Certified Industrial Hygienist), the sampling frequency may be adjusted.

Table 7.3
Integrated Air Sampling

ANALYTE	TYPE OF SAMPLE	METHOD(S)
Arsenic	Area & Personal	NIOSH 7300
Beryllium	Area & Personal	NIOSH 7300
Copper	Area & Personal	NIOSH 7300
Cadmium	Area & Personal	NIOSH 7300
Cyanides (particulate)	Area	NIOSH 7904
Oxides of Nitrogen	Area	S 321
VOCs	Area & Personal	Carbon Tetrachloride NIOSH 1003 Methylene Chloride NIOSH 1005 Perchloroethylene NIOSH 1003 Trichloroethylene NIOSH 1022
Sulfur Dioxide	Area & Personal	NIOSH 6004
Respirable Dust	Area & Personal	NIOSH 600

7.5 DECONTAMINATION

Personnel and equipment contamination prevention techniques will be used wherever feasible. Personnel will avoid unnecessary contact with potentially contaminated material and will adhere to the work practices outlined in Section 7.6. Heavy equipment will be operated in a manner which limits the spread of contaminated or potentially contaminated material.

7.5.1 Personnel Decontamination

To minimize the potential for personal contamination, gross decontamination will be performed on personnel exiting the HCA/EZ prior to doffing their outer layer of Anti-C's and stepping to the inner step-off pad. This decontamination will also serve to prevent the spread of contamination into "clean" areas of the site. Once decontaminated, personnel shall remove PPE as outlined in Section 7.3.5 and step to the inner step-off pad where a whole body frisk will be conducted. Based on a visual determination, PPE suspected of being chemically contaminated will be bagged separately.

Gross decontamination of personnel at the HCA/EZ boundary will consist of the following:

- a visual inspection to determine areas of potential contamination;
- lightly brushing or scrapping to remove gross contamination. This will be done carefully so that the integrity of the PPE is not compromised;
- wiping items such as gloves with premoistened, non-alcohol based wipes;

After whole body frisking at the inner step-off pad, personnel will proceed to the CA/EZ boundary where they will doff their inner set of Anti-C's and step to the outer step-off pad located in the RBA/CRZ for another whole body frisk. For personnel who conduct work in the CA/EZ, a decontamination identical to the one described above will be conducted prior to doffing their Anti-C's at the CA/EZ boundary. After exiting the RBA/CRZ personnel will wash their hands and face prior to eating, drinking, smoking, or chewing.

7.5.2 Equipment Decontamination

All materials and equipment in contact with soils may require decontamination prior to release from the EZ and prior to free release from RFETS to off site locations. At the discretion of the Project Manager, equipment may be decontaminated in the field or transferred to the Main Decontamination Facility. Field decontamination will be conducted in accordance with FO.03, *Field Decontamination Operations*. Main Decontamination Facility operations will be conducted in accordance with FO.04, *Decontamination of Equipment at Decontamination Facilities*, and FO.12, *Decontamination Facility Operations*. Depending on the location and extent of contamination, and the purpose of the decontamination, one or more of the following methods may be used:

- spraying potable water at low pressures;
- spraying potable water at high pressures and high temperatures;
- scrapping and brushing;
- power brushing;
- scrubbing with solutions of Liquinox®, or Pipex®;
- wiping with premoistened, non-alcohol based wipes; and
- rinsing with deionized water.

Decontamination effectiveness will be determined by visual inspection, radiological surveys, and volatile organic vapor monitoring.

7.5.3 Management of Decontamination Liquids and Incidental Waters

Liquids generated during decontaminations will be placed in holding tanks which will also hold any incidental water pumped from the excavation. When needed, the liquids will be sampled per the RMRS SAP and pumped from the holding tanks into tanker trucks for transport to Building 891 or 374 and subsequent treatment.

7.6 WORK PRACTICES

7.6.1 Radiological Work Permit (RWP)

Work within the radiological control areas will be conducted under the stipulations of Radiological Work Permit(s) which will be strictly adhered to at all times. Any personnel conducting work contrary to the RWP will be subject to immediate disciplinary action and may be removed from the project.

7.6.2 Prohibited Activities

The following activities are prohibited:

- smoking outside of designated areas;
- eating, drinking, chewing gum, using smokeless tobacco, or smoking in areas controlled for radiological or chemical purposes;
- eating, drinking, smoking, chewing gum, or using smokeless tobacco prior to washing hands and face after exiting the RBA/CRZ;
- unnecessary contact with contaminated material such as sitting and kneeling;
- any practice that increases the probability of hand-to-mouth transfer and ingestion of contaminated material;
- prescribed drugs taken by personnel on operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician;
- facial hair which interferes with mask to face seal;
- hard, non-permeable contact lenses when wearing respiratory protection; and
- lighters and matches in areas controlled for radiological or chemical purposes.

7.6.3 Spill Prevention

It is the responsibility of all project personnel to conduct work in a manner which prevents the potential release or spill of hazardous materials. The observance of any activity which increases the potential for

a release or spill shall be immediately reported. Spill prevention will include the following work practices:

- waste packages and the front-end loader bucket will be carefully loaded;
- waste packages and the front-end loader will be free of external material accumulation prior to transport within the temporary structure;
- waste packages will be covered prior to transport within the temporary structure;
- waste packages will be sealed prior to transport out of the temporary structure;
- the front-end loader and forklift will travel at a slow speed when transferring soil or waste packages;
- heavy equipment and generators will be carefully refueled so as not to overfill and a secondary containment will used;
- Sampling and Inerting Pad (SIP) operations involving liquids will be conducted within a secondary containment;
- gasoline and diesel containers will be stored in flammable cabinets when not in use;
- heavy equipment will be inspected by the operator prior to the beginning of each shift and an inspection checklist will be completed;
- rigging equipment will be properly tagged and inspected by the user prior to use on a daily bases;
- pumps and hoses used to pump incidental water and other liquids to holding tanks or drums will be visually inspected by the user prior to each operation;
- tanks used to hold incidental water and decontamination liquids will be tested prior to use on the project and inspected daily; and
- tanker trucks used to transfer incidental water and decontamination liquids will be filled in accordance with their safety guidelines.

7.6.4 Dust Control Measures

To prevent generation, dispersion, and potential employee inhalation of particulates, potable water will be sprayed for routine dust suppression during excavation, packaging, loading, transport, dumping, and stockpiling of soil. Water will be sprayed to moisten, not mobilize the soil or create runoff.

7.6.5 Buddy System

All work that requires personnel to directly handle, sample or transport hazardous materials, hazardous waste or waste containers at RFETS requires the use of the buddy system. The responsibility of workers utilizing the buddy system include:

- providing his/her partner with routine and emergency assistance;
- observing his/her partner for signs of chemical or heat stress exposure;

- periodically checking the integrity of his/her partner's PPE; and
- notifying others if emergency help is needed.

In addition, any work requiring greater than Level D protection requires use of the buddy system. At no time shall any worker enter the HCA/EZ, CA/EZ or RBA/CRZ without the use of the buddy system.

7.6.6 Communications

Due to the small work area within the temporary structure and the requirement of the "buddy system" during work activities, face to face communication among workers will be generally maintained. However, due to the use of Level B respiratory protection and the difficulty in communicating, hand signals will be used and personnel will be briefed on their use weekly at the daily/shift health and safety meetings. Radios will be used for communicating with workers in the HCA/EZ and CA/EZ and other plant personnel including emergency responders. Radio channel EMAD-6 will be used for communication during the duration of this project. In addition, telephones are located in each field trailer.

7.6.7 Confined Space Entry

Confined space entry is not authorized for this project. If it is determined during the course of field activities that a confined space entry (i.e., entry into the excavation) is required, an addendum to this HASP will be required. In the event of an emergency, response personnel will be permitted to enter the trench after approval from the competent person (HSS) in charge of inspecting the excavation.

7.6.8 Illumination

A minimum of 5 foot-candles will be maintained in the work areas while work is in progress. If night work is required, it will be performed in compliance with 29 CFR 1926.65 (m), *Illumination.*

7.6.9 Sanitation

Potable water washing and toilet facilities which comply with 29 CFR 1926.65(n) *Sanitation at Temporary Work Places* will be available to all on-site personnel.

7.7 UNANTICIPATED HAZARDS OR CONDITIONS

Unanticipated hazards or conditions encountered during this project will be managed in accordance with this RMRS policy statement (Directive-001). "In the event unanticipated hazards or conditions are encountered, the project activities will pause to assess the potential hazard or condition. The potential hazard or condition will be evaluated to determine the severity or significance of the hazard or condition

and whether the controls on the project are sufficient to address the hazard or condition. Based on this initial evaluation, a determination will be made whether to proceed with controls currently in place; segregate the hazard or condition from the project activity, if it can be done safely; or curtail operations to address the unexpected hazard or condition. Concurrence to proceed down the selected path must be obtained from the RMRS Environmental Restoration Director or designee. In addition, the resumption of field activities involving radiological issues will be in accordance with Article 345 of the RFETS Radiological Control Manual."

Note: "Unanticipated Hazards or Conditions" do not replace conditions which require emergency response, rather, they ensure that all work is performed based on an informed approach in regards to all known or potential hazards.

The following sections list possible "Unanticipated Hazards or Conditions" and the corresponding response action.

7.7.1 Radiological Air Sample Result > RWP Suspension Guide Limits in the Temporary Structure

In order to protect workers within the temporary structure and to prevent the spread of contamination to the outside environment, high and low volume radiological air samples will be obtained inside the temporary structure.

If elevated readings are obtained during the initial counting of a high or low volume radiological air sample, the sample will be evaluated to determine if the elevated reading is due to naturally occurring radioactive material or Uranium^{238}. Evaluation methods may include radon decay tracking, SAIC, Model AP-2 portable alpha analyzer analysis, gamma/alpha spectroscopy analysis, or other analysis as determined by Radiological Safety Technical Supervisor. If an air sample result is confirmed to be greater than the RWP suspension limit for Uranium^{238}, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and the Field Supervisor will be notified;
- RCT's not wearing respiratory protection in the RBA/CRZ will immediately exit the temporary structure;
- the Radiological Safety Technical Supervisor will be notified;
- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
- the ventilation system will be shut down and all doors and vents will be closed;
- if DAC values do not exceed the protection factor of the respirators being worn, all depleted uranium will be placed in a fire-safe configuration via inerting as follows;

- SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
- the excavator operator will inert material in the trench with non-uranium containing soil;

- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- based on sample and radiological survey results, potential personal radiological exposures will be reviewed;
- site controls and work practices will be reviewed and modified as necessary; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.2 CAM Alarm Inside the Temporary Structure Vestibule (CA/EZ)

Continuous Air Monitors will be operated in the temporary structure vestibules. If a CAM alarms, the following actions will be taken:

- personnel not wearing respiratory protection in the vestibule with the alarming CAM will immediately exit the temporary structure and relocate to a safe upwind assembly area;
- the Radiological Safety Technical Supervisor will be notified;
- the Field Operations Deputy Project Manager or designee and the Field Supervisor will be notified;
- personnel outside the temporary structure will relocate to a safe upwind assembly area;
- the vestibule doors will be closed;
- personnel wearing SCBAs will refill their SCBAs at the non-alarming CAM vestibule;
- if the CAMs at both vestibules are alarming and SCBA users have low level alarm and are unable to refill their air cylinders, SCBA wearers will immediately exit the tent;
- high and low volume air samples in the temporary structure will be obtained and evaluated;
- the alarm will be evaluated in accordance with RSP-4.01 *Continuous Air Monitor - Use*

If a CAM alarm is verified as positive, the following actions will be taken:

- all nonessential personnel will exit the temporary structure as directed by RCTs and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
- the ventilation system will be shut down and all doors and vents will be closed;
- if DAC values do not exceed the protection factor of the respirators being worn, all depleted uranium will be placed in a fire-safe configuration via inerting as follows;

- SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
- the excavator operator will inert material in the trench with non-uranium containing soil;

- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- based on sample and radiological survey results, potential personal radiological exposures will be reviewed;
- site controls and work practices will be reviewed and modified as necessary; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.3 Equipment Radiological Contamination or Radiation Levels > RWP Suspension Limits

Should Uranium^{238} contamination or radiation levels greater than the suspension limits stated on the RWP be detected, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and the Field Supervisor will be notified;
- the Radiological Safety Technical Supervisor will be notified;
- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
- all depleted uranium will be placed in a fire-safe configuration via inerting as follows;
  - SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
  - the excavator operator will inert material in the trench with non-uranium containing soil;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- based on the survey results, site controls, and work practices will be reviewed and modified as necessary; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.4 Personnel Radiological Contamination

Personnel will be frisked when exiting the CA/EZ. If levels >MDC of the instrument at the outer step-off pad are detected on personnel after the removal of personal protective equipment, the following actions

will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and the Field Supervisor will be notified;
- the Radiological Safety Technical Supervisor will be notified;
- depending on the location and level of contamination, the appropriate actions will be taken to protect the contaminated individual and personnel in the area;
- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
- all depleted uranium will be placed in a fire-safe configuration via inerting as follows;
  - SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
  - the excavator operator will inert material in the trench with non-uranium containing soil;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- based on the contamination levels, site controls and work practices will be reviewed and modified, if necessary; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.5 Confirmed Presence of Plutonium or Fissile/Enriched Uranium

Should AP-2 portable alpha analyzer, gamma/alpha spectroscopy, or laboratory analysis indicate the presence Plutonium or fissile/enriched Uranium above the action levels stated in Table 7.2, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and the Field Supervisor will be notified;
- RCT's not wearing respiratory protection in the RBA/CRZ will immediately exit the temporary structure;
- the Radiological Safety Technical Supervisor will be notified;
- Nuclear Safety, Criticality Safety, and Air Quality will be notified as appropriate;
- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
- the ventilation system will be shut down and all doors and vents will be closed;

- if DAC values do not exceed the protection factor of the respirators being worn, all depleted uranium will be placed in a fire-safe configuration via inerting as follows;
  - SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
  - the excavator operator will inert material in the trench with non-uranium containing soil;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- DAC value will be recalculated and potential personal radiological exposures will be evaluated;
- based on the level of Plutonium or fissile/enriched Uranium, site controls and work practices will be reviewed and modified as necessary; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.6 Chemical Air Monitoring >Action Levels in the RBA/CRZ or Outside the Temporary Structure

In order to protect collocated workers in the RBA/CRZ and project support zone, real-time chemical air monitoring will be conducted in those areas. Should real-time air monitoring indicate the sustained presence (approximately ten seconds) of chemicals at levels greater than the action levels for personnel without respiratory protection in the RBA/CRZ and project support zone, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and Field Supervisor will be notified;
- all personnel in the RBA/CRZ and support zone will be relocated to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***)
- Industrial Hygiene supervision will be notified;
- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area;
- all depleted uranium will be placed in a fire-safe configuration via inerting as follows;
  - SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
  - the excavator operator will inert material in the trench with non-uranium containing soil;;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- based on monitoring results potential personal chemical exposures will be reviewed;

- based on monitoring results, site control and work practices will be reviewed and modified; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.7 Chemical Air Monitoring or Sample Results > IDLH Action Levels

The exhaust system on the temporary structure is designed to maintain atmospheric chemical levels below the level which is Immediately Dangerous to Life and Health (IDLH). However, if real-time air monitoring or personal or area integrated sample results indicate chemical levels greater than the IDLH for any chemical, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and Field Supervisor will be notified;
- Industrial Hygiene supervision will be notified;
- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area;
- if real-time air monitoring results do not exceed the protection factor of the respirators being worn, all depleted uranium will be placed in a fire-safe configuration via inerting as follows;
  - SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
  - the excavator operator will inert material in the trench with non-uranium containing soil;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- based on air monitoring and sampling results, potential personal chemical exposures will be reviewed;
- based on air monitoring and sampling results, work practices and engineering controls will be reviewed and modified; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.8 Personnel Chemical Contamination

If any site worker experiences a failure or alteration of protective equipment that affects the protection factor, that person and his/her coworker(s) will immediately leave the work area for which the PPE was required. Re-entry to the area will not be permitted until the equipment has been repaired or replaced. If any incidents occur that involve the wetting of non-impermeable clothing with hazardous substances,

the visual chemical contamination of the modesty clothing or skin, or an employee experiences symptoms of contamination such as skin irritation, the following actions will be taken:

- the Field Operations Deputy Project Manager and Field Operations Deputy Project Manager will be notified immediately;
- the RFETS emergency services at extension **2911** will be notified;
- chemically contaminated personnel should proceed to the nearest decontamination safety shower, remove affected clothing, and thoroughly irrigate the contaminated areas. Emergency shower and eyewash stations are located at numerous locations at the site (see Figure 3.4 for locations); and
- the chemically contaminated individual will be transported to RFETS Occupational Medicine for evaluation;
- based on the severity and cause of the personal chemical contamination, work practices will be reviewed and modified as necessary;

7.7.9 Confirmed Presence of Beryllium

If personal or area integrated air sample results exceed 0.5 $\mu g/m^3$ or if surface contamination swipe sample results exceed 2.0 $\mu g/ft^2$, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and Field Supervisor will be notified;
- Industrial Hygiene supervision will be notified;
- the temporary structure will be posted as a "Beryllium Area";
- based on air sampling and surface contamination results, site control, work practices, training requirements, and medical surveillance will be reviewed and modified; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume

7.7.10 Confirmed Presence of Arsenic or Cadmium

Personal or area integrated air samples for Arsenic and Cadmium are not anticipated to exceed the Permissible Exposure Limit. However, if results exceed 0.01 mg/m^3 for Arsenic or 0.005 mg/m^3 for Cadmium, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and Field Supervisor will be notified;
- Industrial Hygiene supervision will be notified;

- the temporary structure will be posted as a "Regulated Area" depending on the contaminant present;
- based on air sampling results, site control, work practices, training requirements, and medical surveillance will be reviewed and modified per OSHA Title 29 CFR 1910.1018 *Inorganic Arsenic* or Title 29 CFR 1910.1027 *Cadmium,* as appropriate; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.11 Encountering Unusual Debris During Excavation

Historical data indicates debris associated with Trench 1 Site is limited to waste personal protective equipment, wood, metal, rubber, plastics, fiberglass, paper, and glass. However, if an item such as a sealed canister or a compressed gas cylinder is encountered, the following actions will be taken:

- excavation activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and the Field Supervisor will be notified;
- the Radiological Safety Technical Supervisor will be notified;
- information regarding the debris will be gathered form a distance. This will include any labels, markings, or other visual clues as to the nature of the debris. If safe to do so, personnel will conduct radiation and contamination surveys and monitor the debris for chemical and combustible gases;
- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
- all depleted uranium will be placed in a fire-safe configuration via inerting as follows;
  - SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
  - the excavator operator will inert material in the trench with non-uranium containing soil;;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- based on the information gathered radiological surveys, chemical and combustible gas monitoring results, and other characterization data, further handling of the debris will evaluated and work practices will be reviewed and modified if necessary; and
- Upon approval from the RMRS Environmental Restoration Director or designee, excavation activities will resume.

7.7.12 Presence of Volatile Organic Compounds in Soil

If analytical results show volatile organic compounds at levels greater than 114 parts-per-million in the soil, Air Quality Management shall be notified to determine if additional air emissions analysis and/or revisions to the Air Pollution Emission Notice will be required.

7.7.13 Breathing Air Compressor Failure

Breathing air for the SCBAs and airline respirators will be supplied by two field located breathing air compressors. The breathing air supply systems are designed so that if the compressors fail there is an adequate supply of stored air to allow personnel to place the depleted uranium in a fire-safe configuration and egress the temporary structure. However, if a compressor fails or an out-of-specification situation as stated in Operations Order No. 00-T1-05, *Use of MSA Custom 4500 II Self Contained Breathing Apparatus and PremAire™ Air Line System* develops, the following actions will be taken:

- all activities will be immediately suspended and the Field Operations Deputy Project Manager or designee and Field Supervisor will be notified;
- RMRS Industrial Hygiene supervision will be notified;
- all nonessential personnel will exit the temporary structure by normal egress routes;
- all depleted uranium will be placed in a fire-safe configuration via inerting as follows;
    - SIP personnel will immediately inert all depleted uranium waste packages heading to or already at the SIP; and
    - the excavator operator will inert material in the trench with non-uranium containing soil;;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure; and
- upon approval from the RMRS Environmental Restoration Director or designee, work activities will resume.

7.7.14 Electronic Personal Dosimeter Alarm Inside the Temporary Structure

Electronic Personal Dosimeters (EPDs) will be issued to selected personnel as determined by Radiological Engineering. The EPDs will track personnel exposures on a daily basis and will alarm at unexpected area radiation dose rates greater than 2mrad/hr. If the alarm on any EPD activates , the following actions will be taken:

- the Field Operations Deputy Project Manager or designee and the Field Supervisor will be notified;

- the Radiological Safety Technical Supervisor will be notified;
- personnel in the temporary structure will relocate to an area of known dose rate less than 2mrad/hr;
- an RCT will respond to the alarming monitor and survey the area with an RO-20 to determine the dose rate level and locate the source of the radiation;
- if dose rates exceed the 2mrad/hr administrative limit, the source of the radiation will be controlled, if possible;
- if dose rates exceed the 5mrad/hr at 30 centimeters, the area will be posted as a "Radiation Area"
- if dose rates exceed 10mrad/hr at 30 centimeters or 300 mrad/hr beta radiation on contact, work will be suspended as stated in section 7.7.3; and
- if work is not suspended, site controls, and work practices will be reviewed and modified as necessary.

8.0 FIRE PREVENTION PLAN

Due to the unique nature of the Trench 1 site and its operations, fire prevention is integral to minimizing the potential for the occurrence of a fire. The following sections describe the preventative measures to be implemented for each type of fire hazard present in both the temporary structure and the field trailers. The fire prevention measures were developed in conjunction with the *Fire Hazard Analysis, Temporary Structures for the Trench 1 Source Removal Project, Revision 0*, which was prepared by RFETS Fire Protection Engineering. General fire prevention measures and fire prevention inspections are discussed at the end of this section.

8.1 COMBUSTIBLE MATERIALS - CLASS A FIRES

This section addresses the fire prevention measures associated with fires in ordinary combustible materials where an ash remains, such as wood, cloth, rubber, and paper.

8.1.1 Temporary Structure

Combustible materials may include wood, paper, rubber, plastic, and spent personal protective equipment excavated from the trench. Personal protective equipment will also be generated by personnel involved with the actual work activities. Fire prevention measures are as follows:

- excavated combustible material will be placed in steel containers which will be sealed at the end of each shift;
- used personal protective equipment will be packaged in sealed steel containers or removed from the temporary structure at the end of each shift; and
- exposed combustible material in the trench will be covered with a sufficient amount of clean soil to ensure that any undetected depleted uranium does not ignite the material

8.1.2 Temporary Field Trailers

Combustible material in the field trailers will include typical office supplies, rubbish, furniture, and stored personal protective equipment. Fire prevention measures are as follows:

- combustible material, including personal protective equipment, shall be stored in an orderly fashion and a high level of housekeeping shall be maintained at all times;
- combustible material not required for operations shall not be stored within the trailers; and
- combustible materials shall be maintained at least two feet below the ceilings in all trailers.

8.2. FLAMMABLE AND COMBUSTIBLE LIQUIDS - CLASS B FIRES

This section addresses the fire prevention measures associated with fires involving flammable or combustible liquids such as diesel fuel, gasoline, and mineral oil.

8.2.1 Temporary Structure

Flammable and combustible liquid use inside the temporary structure is limited to the diesel in the heavy equipment fuel tanks and the mineral oil used to inert the depleted uranium. Gasoline fueled water pumps for dust suppression, diesel generators for power inside the temporary structure, diesel light plants for additional site lighting, and bulk storage of mineral oil will be located outside the tent structure. Fire prevention measures pertaining to flammable and combustible liquid use in and near the temporary structure are as follows:

- fueling of heavy equipment in the temporary structure will be done in accordance with Operations Order No. *Refueling of Heavy Equipment Within the Temporary Structure*;
- with the exception of the mineral oil in the inerted drums and diesel in heavy equipment fuel tanks, introduction of flammable or combustible liquids into the temporary structure is prohibited;
- gasoline fueled water pumps, diesel generators and light plants, and the bulk mineral oil storage area will be located at least ten feet from the outer wall of the temporary structure;
- if possible, fueling of diesel or gasoline fueled pumps, generators, and light plants will be conducted at the beginning of each shift when the units are cool;
- when conducting diesel or gasoline fueling operations from a fuel truck, the fuel truck will be bonded to the item being refueled;
- when fueling diesel or gasoline fueled pumps, generators, and light plants from a safety can, the safety can and the item being refueled will be bonded and the item being refueled will be properly grounded; and
- when not in use, flammable or combustible liquids will be stored in an FM or UL approved flammable storage cabinets.

8.2.2 Temporary Field Trailers

The use and storage of flammable or combustible liquids in the field trailers is prohibited.

8.3 ENERGIZED ELECTRICAL EQUIPMENT - CLASS C FIRES

This section addresses the fire prevention measures associated with fires which involve energized electrical equipment.

8.3.1 Temporary Structure

Energized electrical equipment in the tent will be limited to low and high volume radiological air samplers, light plants, and hand tools. Power will be supplied to the equipment via extension cords plugged into hard wired outlets or generators. Other energized electrical equipment includes the twelve 4,185 cfm roof mounted explosion proof exhaust fans and two breathing air compressors. The fans and the compressors will be hard wired. Fire prevention measures in regards to energized electrical equipment are as follows:

- the new hard wire electrical design has been approved by Facility Engineering;
- changes to the electrical design require approval from Facility Engineering;
- electrical equipment will be UL listed and in good repair;
- equipment and extension cords will be inspected by the user prior to use on a daily basis and protected from unnecessary damage. Damaged equipment or cords will be immediately tagged out of service and repaired or replaced;
- low and high volume radiological air samplers, light plants, and hand tools will be plugged into a GFCI protected outlet; and
- equipment not in use will be unplugged.

8.3.2 Temporary Field Trailers

Electrical hazards associated with the field trailers include computers, radiological and industrial hygiene instrumentation, the charging of battery operated equipment such as radios, and several refrigerators and coffee pots. Fire prevention measures associated with electrical hazards in the field trailers are as follows:

- electrical receptacle strips shall be FM or UL approved;
- electrical receptacle strips shall be unplugged or approved for continuous use;
- equipment will be UL approved;
- equipment with damaged electrical cords will be immediately tagged out of service and repaired or replaced;
- coffee makers shall be placed on non-combustible surfaces and have an operable indicator light. The area immediately around coffee makers shall be free of combustible material; and
- portable electric heaters are not allowed in any of the trailers except as approved on a case-by-case basis.

8.4 COMBUSTIBLE METALS - CLASS D FIRES

Depleted uranium fires pose unique hazards due to extinguishment difficulty and the potential release of airborne radioactive particulates. The following section details preventative measures to mitigate the

potential of a depleted uranium fire.

8.4.1 Temporary Structure

During excavation, packaging, transportation, sampling and inerting of depleted uranium within the temporary structure, the potential for a depleted uranium fire exists. Preventative measures are as follows:

- the Fire Safety Officer will obtain and track temperature measurements of depleted uranium drums and other depleted uranium-containing wastes in accordance with Operations Order No. 00-T1-09, *Temperature Measurements of Depleted Uranium Using Infrared Heat Gun;*
- the Fire Safety Officer will visually inspect the work area for uncontrolled depleted uranium chips during and at the end of each shift. This includes an inspection of the trackhoe teeth and bucket;
- all depleted uranium, except analytical samples, will be inerted as soon as possible after excavation and prior to the end of each shift;
- waste packages containing inerted depleted uranium will be sealed prior to the end of each shift;
- once removed from the trench, depleted uranium will be carefully handled to minimize the introduction of energy and the potential for unnecessary friction; and
- in the event of a controlled evacuation, all depleted uranium will be immediately inerted with mineral oil or soil. This includes placing soil over any exposed uranium in the trench.

8.4.2 Temporary Field Trailers

Handling of depleted uranium in the temporary field trailers will be strictly limited to the handling sealed samples in Room No. 3 of T900G and the gamma spectroscopy laboratory located in T900C. All on-site transfers, movements, and handling of potentially pyrophoric samples will be in accordance with Operations Order No. 00-T1-04 *Storage and Transfer of Potentially Pyrophoric Uranium On-site*

- sample containers shall be properly packaged and labeled prior to exiting the temporary structure;
- an approved storage area will be established in Room No. 3, T900G and T900C;
- any deviation from the prescribed requirements, shall require approval from the Program Manager, Fire Protection Engineering.

8.5 GENERAL FIRE PREVENTION MEASURES

This section addresses general fire prevention measures in regards to storage and use of flammable gases, and control of ignition sources.

8.5.1 Storage and Use of Flammable Gases

The introduction of flammable gases into the temporary structure is prohibited except for the small amount of ultra-pure hydrogen which will be used as a fuel source for the Foxboro Inc., Model TVA-1000 flame ionization detector.

Flammable gases associated with the temporary field trailers will be limited to the storage and use of ultra-pure hydrogen used to fuel the above mentioned flame ionization detector. Fire prevention measures associated with flammable gases are as follows:

- the volume of flammable gas in a field trailer will be limited based on volume, such that if released into a room the resulting concentration would be below 25% of the lower explosive limit;
- flammable gas storage areas will be labeled;
- flammable gas cylinders will be secured in the upright position;
- cylinders and systems will be properly labeled;
- regulators and fittings will be properly tightened and inspected prior to use; and
- regulators shall be removed and the cap installed when cylinders are not in use.

8.5.2 Control of Ignition Sources

Ignition sources such as lit cigarettes and open flames will be controlled in the following manner:

- smoking is not allowed anywhere on site except in the designated smoking area;
- approved cigarette butt cans will be used in the designated smoking area;
- welding and cutting activities are prohibited except as approved on a case-by-case basis in accordance with HSP-31.10 *Hot Work;*
- lightheads on portable light plants inside the temporary structure will be kept at least two feet from the tent panels; and
- heavy equipment inside the temporary structure will be operated in a manner which will keep the exhaust stacks at least three feet from the tent panels.

8.6 FIRE PREVENTION INSPECTIONS

Fire prevention inspections will be conducted and documented in accordance with HSP-31.06 *Fire Prevention Inspections.* The inspections will be conducted by the Fire Prevention Inspector prior to the beginning of work and thereafter at a frequency determined by the Fire Department Manager. The inspections will include, at a minimum, the following areas and subjects:

- exterior of the facility - access roads, firelanes
- exits and passageways
- life safety features
- fire protection systems, appliances, components
- flammable liquids and cabinets
- compressed gas cylinders
- heat producing devices
- RCRA areas
- egress routes
- general hazards

Any concerns found during the fire prevention inspections will be immediately corrected by the Field Operations Deputy Project Manager.

9.0 EMERGENCY RESPONSE PLANNING

The Emergency Response Plan is designed to establish a program/plan to optimize a safe and informed response to incidental and emergency situations with the intent of protecting Trench 1 site project personnel, collocated workers, the public, the environment, and property in the event of hazardous substance releases, employee contamination, accidents, injuries, fire, and natural disasters. Preparatory steps necessary for responding to an emergency situation are given below and they should be complied with before beginning any work at the site.

9.1 EMERGENCY RESPONSE PERSONNEL

The Field Operations Deputy Project Manager or designee will assume the role of Incident Commander during all evacuations and emergency response activities until relieved by Rocky Flats Fire Department personnel or the Shift Superintendent. Activation of the RFETS Emergency Plan will be determined by the Fire Department or the Shift Superintendent in accordance with 1-PRO-T56-EP-04.00, *Emergency Classification and Protective Actions*.

9.2 NOTIFICATIONS

Initial discovery and reporting of an emergency or abnormal event is essential to getting the proper response, assessment, and mitigation actions. All Site personnel are responsible for reporting of an emergency, abnormal event, uncontrolled release, or unusual incident which could impact the health and safety of Trench 1 project personnel, collocated workers, the public, and the environment.

The individual discovering an emergency or abnormal event shall report the condition to the Field Operations Deputy Project Manager, the Field Supervisor or the Site Safety Officer, and the Shift Superintendent, as applicable and as follows:

- Life-threatening Situations - In case of an life-threatening emergency, RFETS emergency services must be notified. Kaiser-Hill maintains an emergency response telephone extension of **2911** at RFETS. Extension **2911** may be reached from any plant site telephone or on Radio Channel 2911 and will immediately connect the caller with the Fire Department, the Central Alarm Station, the Shift Superintendent and, during first shift, Occupational Health. Site extension 2911 will also be used when the facts of the situation are not fully known.

- Non-life-threatening Situations- Individuals will notify the Field Operations Deputy Project Manager, the Field Supervisor, or the Site Safety Officer for non-life-threatening situations.

Note: Report all emergency situations, whether they are life-threatening or not, on radio channel or telephone extension 2911.

Table 9.1 presents a list of Trench 1 site project personnel who will be notified in the event of any spill, release, employee contamination, accident, injury, fire, or natural disaster. These phone, radio and pager numbers will be posted next to telephones and at prominent locations at the site. Any revisions to the list must be posted and all personnel notified of the changes. If applicable, further reporting will be conducted in accordance with Administrative Procedures Manual, ADM-16.01, *Occurrence Reporting Process*.

9.3 PERSONNEL ACCOUNTABILITY

The Personnel Accountability Tag System will be used to enhance the health and safety of personnel working at or visiting the Trench 1 Site. Personnel Accountability Tags will be issued to and used by all employees, visitors, vendors, and contractors each time they enter and exit the site.

Upon entering the site, each individual will place their Personnel Accountability Tag on the Trench 1 Site Personnel Accountability Tag Board (See Figure 3.3). The Personnel Accountability Tag remains on the board during the period of time the individual is physically at the Trench 1 Site. Upon exiting the Trench 1 Site, each individual will retrieve their Personnel Accountability Tag.

In the event of an evacuation at the Trench 1 Site, the Personnel Accountability Board will be removed from the normal location and taken to the designated primary assembly area. The board will be relocated to a designated alternate assembly area if the primary assembly area cannot be used. If not picked up during the evacuation, personnel will retrieve their tags at the assembly area. Personnel accountability is required immediately following a Trench 1 Site evacuation and will be accomplished within 30 minutes (not to exceed 45 minutes) from the initiation of the evacuation. Individuals whose Personnel Accountability Tags remain on the board after the retrieval process will be reported as "missing." The personnel accountability status is completed when all tags are retrieved or a list of unclaimed tags is generated and the personnel are reported as missing. If necessary, the Incident Commander will provide assistance to the Field Operations Deputy Project Manager in coordinating a Trench 1 Site and/or RFETS search for the missing personnel.

Table 9.1
Emergency Telephone Numbers

RFETS EMERGENCY RESPONSE EXTENSION — **RFETS Phone: 2911**, **RFETS Radio: 2911**

RFETS SHIFT SUPERINTENDENT — **RFETS Phone: 2914**, **RFETS Radio: 3301**

RMRS EMERGENCY CONTACTS					
Name	Company/Title	RFETS Phone	Pager	Radio	Home Phone
Wayne Sproles	Project Manager	5790	212-5651	3711	
Mark Burmeister	Deputy Project Manager	5891	212-6228	-	
Rick Wagner	Deputy Project Manager	3102	212-6363	3798	
David F. Farler	Health and Safety Supervisor	4340	5248	3743	
Ken Gillespie	Site Safety Officer	3439	4007	3733	
Annette Primrose	Field Operations Manager	4385	212-6338	3801	
Bruce Watson	Group Manger, Radiation Control Compliance	2627	7513	-	
Jeff Barroso	Alternate Group Manger, Radiation Control Compliance	8451	5888	Site Survey Channel	
Jim Langsted	Alternate Group Manger, Radiation Control Compliance	2542	3425	-	
STARMET TEAM EMERGENCY CONTACTS					
Name	Company/Title	RFETS Phone	Pager	Radio	Home Phone
Don Barbour	Project Manager	4518	-	EMAD6	
Nick Lombardo	Project Supervisor	4518	859-0751	EMAD6	
Curt Hull	Assistant Project Supervisor	4518	-	EMAD6	
Debra Nims	Health and Safety Program Manager	4518	-	EMAD6	
Noelle Cochran	Quality Assurance Officer	4518	-	EMAD6	
Steve Lopez	Project Manager	4518	-	EMAD6	

9.4 SITE EVACUATION

The Field Operations Deputy Project Manager, with assistance from the Field Supervisor and the Site Safety Officer directs all evacuations of the Trench 1 Site. Based on the nature and severity of the situation, there are two ways that the Trench 1 Site can be evacuated. They are as follows:

- Immediate Evacuation: Three short blasts from an air horn alarm will indicate an emergency evacuation during which personnel will immediately evacuate the Site. Personnel inside the temporary structure will exit via the nearest exit without stopping for frisking or decontamination.
- Controlled Evacuation: One long blast from an air horn alarm indicates a controlled evacuation. Non-essential personnel inside the temporary structure shall exit the structure following normal egress means including personal frisking and decontamination. All depleted uranium will be placed in a fire-safe configuration via inerting. Once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure.

Regardless of the type of evacuation, the Shift Superintendent will be notified and all personnel will proceed to the designated assembly area and will be accounted for using the Personnel Accountability Tag System. Evacuation routes and assembly areas are shown on Figure 9.1 which will be posted next to the telephones and in prominent locations at the site.

9.5 MEANS OF EGRESS

9.5.1 Temporary Structure

The temporary structure is equipped with nine outward swinging single personnel doors and two outward swinging double personnel doors and are arranged so that the path of travel from any point in the structure is less than 100 feet. All doors measure 36" in width and 6'8" in height and are equipped with panic hardware and marked with internally lit exit signs.

9.5.2 Temporary Field Trailers

There are two outward swinging personnel doors from each of the three trailers. Corridors, egress aisles, and doors all measure 36" in width. Signs mark the exit doors and doors which are not exits are also clearly marked. Egress aisles leading to and discharge points from the exits will be kept clear at all times.

9.6 MEDICAL SUPPORT

The Rocky Flats Medical Facility in Building 122 and the Rocky Flats Fire Department will be used for medical injuries and emergencies. Depending on the seriousness of the injury, injured personnel may also require care by an off-site hospital. The need for off-site care will be determined by the Fire Department or Occupational Health.

The Rocky Flats Fire Department will be called at extension 2911 for all medical injuries and emergencies regardless of the severity. In addition, the Fire Department will be responsible for transporting all injured personnel to RFETS Medical. The Trench 1 project team will have a minimum of one staff member trained in American Red Cross First Aid and CPR on site during each shift.

Directions to the Rocky Flats Medical Facility from the Trench 1 Site are as follows:

From the Trench 1 Site, go south and turn right (west) onto Central Avenue. Continue west on Central Avenue for approximately 1.25 miles. Building 122 will be on the left (south) side of Central Avenue. A map showing the location of Building 122 is shown in Figure 9.2 and will be posted next to telephones and at prominent locations at the site.

The medical clinic in Building 122 is operated during the following business hours:

Monday & Tuesday	6:30 AM - 4:30 PM
Wednesday & Thursday	6:30 AM - 6:00 PM
AWS Fridays	6:30 AM - 3:30 PM

9.7 EMERGENCY EQUIPMENT

A 50 gallon universal spill kit will be located at an appropriate location selected during site mobilization. The universal sorbents contained in the spill kit are effective on a wide range of liquids including acids, bases, solvents, and lubricants eliminating the need for specific sorbents for specific spills. The spill kit contains the following items:

- (5) 5"X10' socks/booms
- (25) one liter pillows
- (75) 18"X18" pads
- (24) disposal bags
- (2) pair SilverShield® gloves

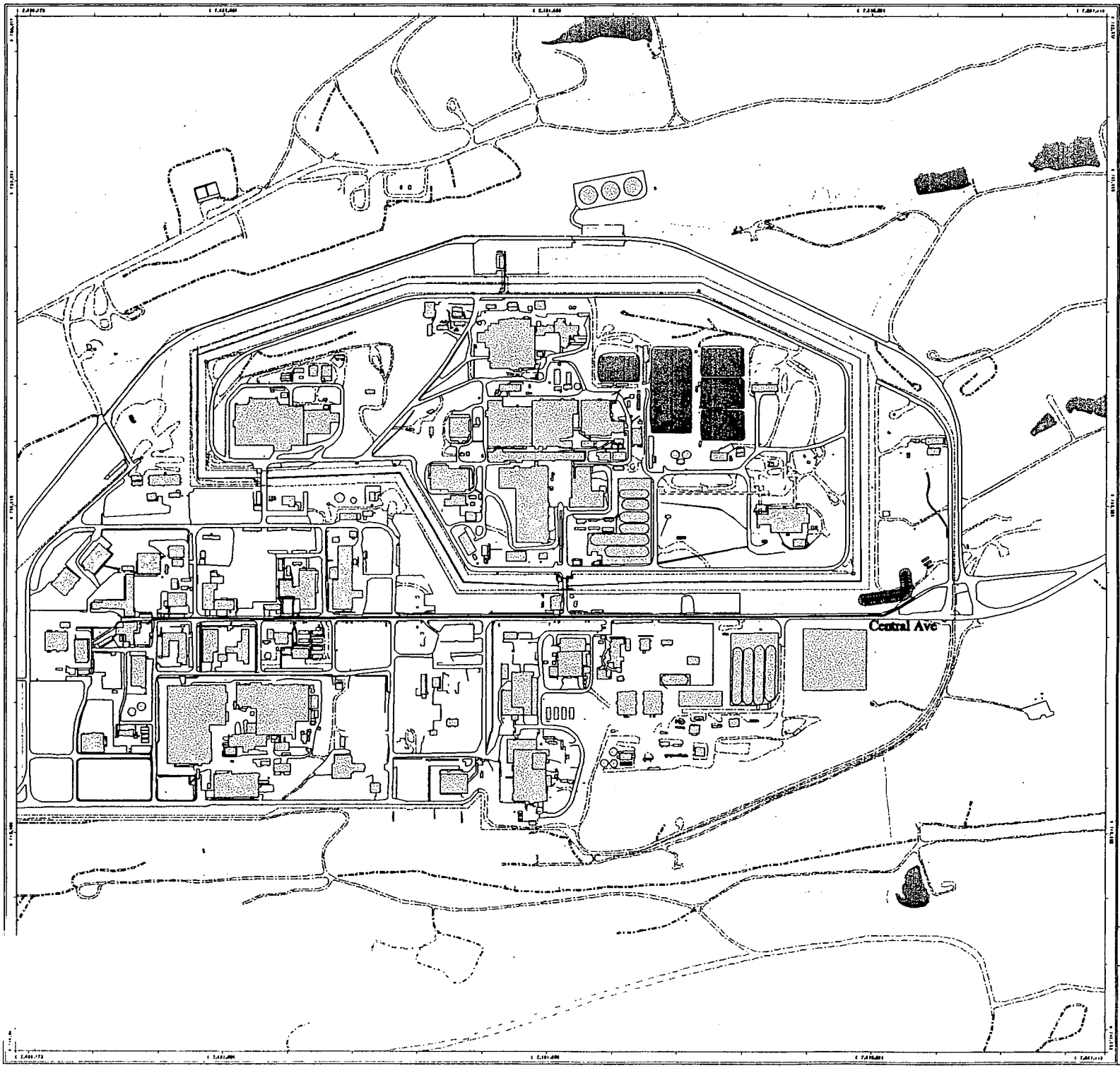


Figure 9.2
Map to RFETS Medical - Building 122

EXPLANATION

- Emergency Facility
- Emergency Route

Standard Map Features

- Building & other structures
- Buildings and other structures
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSI, Las Vegas. Digitized from the orthophotographs. 1/95

Scale = 1 : 10000
1 inch represents approximately 830 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: 98-0099 April 15, 1998

/gis2/projects/hyg98/98-0099/fig9-2.aml

- (2) pair nitrile gloves
- (2) pair goggles
- (2) pair Tyvek® QC coveralls, XL
- (1) 1-quart non-sparking scoop
- (1) plastic non-sparking shovel
- (1) floor-stand spill sign
- (1) 2-lb. dry acid neutralizer
- (1) 2-lb. dry base neutralizer
- (1) jumbo pH paper
- (1) repair putty stick
- (1) roll barricade tape
- (2) rolls white vinyl tape
- (2) rolls yellow vinyl tape
- radiological and hazardous waste labels
- spill response guide

The following emergency response related items will also be available in the work area.

- multiple 10 lb A/B/C & Met-L-X fire extinguishers (see Figure 3.4 for locations);
- a 50 lb wheeled ABC fire extinguisher located in the heavy equipment refueling area
- two 150 lb wheeled Met-L-X fire extinguishers, one trench side, one at the SIP
- emergency shower and eyewash stations
- limited water supply and hoses
- ladder for emergency access and egress into and from the trench
- a spill kit with absorbent materials will also be maintained at the SIP

In addition to the items located at the Trench 1 Site, the Rocky Flats Fire Department has the following numbers and types of mobile emergency response apparatus and equipment:

- (3) Class A, 1250 gpm Engines
- (2) Advanced Life Support Ambulances
- (1) Heavy Rescue Unit
- (1) Haz-Mat Van
- (1) Haz-Mat Trailer
- (1) Breathing Air Trailer
- (1) Technical Rescue Trailer
- (1) Command Vehicle
- (4) Mobile Support Units, and
- (3) Central Supply Haz-Mat Cargo Containers

9.8 EMERGENCY EQUIPMENT INSPECTIONS

Inspection of emergency response equipment will be conducted in accordance with Operations Order No. 00-T1-10 *Inspection of Emergency Response and Safety Equipment*. Items to be inspected include:

- Fire Extinguishers
- Emergency Shower and Eyewash Stations
- Spill Kits
- Ladder for Excavation Emergencies

9.9 TRAINING FOR EMERGENCY RESPONSE

Prior to performing work assignments, Trench 1 personnel will be briefed on hazards present at the Site, notification methods, and emergency response actions. Personnel will be advised through daily health and safety briefings of any new hazards or changes to emergency response actions.

In addition to the above mentioned briefing topics, the following emergency response training will be required for personnel as designated by the Field Operations Deputy Project Manager:

- Incident Commander Training: Required for individuals who may assume the role of the Incident Commander including the following personnel:
  - Field Operations Deputy Project Manager;
- First Responder Awareness Level Training: Required for individuals who are likely to witness or discover a hazardous material release. This training requirement will be fulfilled by site personnel through the completion of 40-hour Hazardous Waste Operations;
- Hazardous Materials Operations for First Responders: Required for individuals who will respond to releases or potential releases as part of the initial response for the purpose of protecting nearby personnel, property, or the environment including the following personnel;
  - Site Safety Officer;
  - Health and Safety Specialist; and
- Dry Chemical and Met-L-X Fire Extinguisher Training: Required for individuals who will respond to fires if it can be done safely.

9.10 ROCKY FLATS FIRE DEPARTMENT PRE FIRE PLAN

To facilitate an informed and effective response to a fire at the Trench 1 Site, the Rocky Flats Fire Department will develop a Pre Fire Plan.

9.11 DRILLS AND EXERCISES

Prior to the beginning of work at the Trench 1 Site, drills will be conducted to evaluate readiness for project execution. The types of drills to be conducted will be determined by the Field Operations Deputy Project Manager and the Emergency Preparedness Administrator for Solid Waste Operations.

9.12 SITE SECURITY/CONTROL

During the initial phases of an emergency, site security/control will be implemented by the on-site Incident Commander with assistance from the Site Safety Officer and the Health and Safety Specialists. Upon notification of the Shift Superintendent, Wackenhut security personnel will assume the role of site security/control including the control of vehicular traffic.

9.13 AIR HORN ALARMS

Air horn alarms will be located at various locations in the temporary structure as shown on Figure 3.4. They will be clearly labeled, unobstructed and readily accessible at all times. One of the air horn alarms will be tested for operation every two months. Testing will be conducted so that no individual air horn is used for two consecutive tests.

10.0 EMERGENCY RESPONSE ACTIONS

Safety precautions will be taken to avoid emergency situations. However, if an emergency does arise, the actions described in this section will be followed. The Field Operations Deputy Project Manager or designee will assume the role of Incident Commander until properly relieved by the Fire Department or the Shift Superintendent.

10.1 HAZARDOUS SUBSTANCE RELEASE

All spills will be addressed per HSP-21.04, *Emergency Response and Spill Control Program."*

10.1.1 Incidental Spill Operations

Incidental Spill Definition:

Incidental spills are those where the substance can be safely absorbed, neutralized, or otherwise controlled by employees in the immediate release area at the time of the release. In addition, the release does not have the potential to become an emergency within a short time frame.

Note: The incidental spill definition does not apply to small spills within the temporary structure which are anticipated during the excavation and handling of material. Rather, it is intended to address unanticipated spills inside the temporary structure and any spill outside of the temporary structure.

Criteria which must be met prior to incidental release response actions at Trench 1 include:

- personnel have warned others and isolated the area to prevent vehicle traffic through the area and minimize personnel exposures;
- the RFETS Shift Superintendent, the Fire Department, and Field Operations Deputy Project Manager have been notified and provided with the following information;
  - exact location of the spill;
  - type of spill;
  - volume of the spill;
  - time of the spill; and
  - response actions to be taken.
- the Radiological Safety Technical Supervisor has been notified;
- Air Quality Management has been notified of potential unexpected release;
- all nonessential personnel have been relocated to a safe upwind assembly area;
- the chemical and radiological hazards of the substance spilled are known;

- it has been determined that the PPE normally worn will provide adequate personal protection;
- decontamination methods are suitable for the substance spilled;
- all materials or equipment used during the response are compatible with the substance spilled; and
- the Shift Superintendent or a representative from the RFETS emergency response team is at the site to observe the spill response and cleanup.

Incidental Spill Response Actions

In the event of an incidental spill involving soils, the soil will be excavated with a front-end loader or applicable equipment depending on the volume of the spilled soil and placed in the soil stockpile or appropriate container. Project RCTs will survey the area with appropriate instruments to ensure removal of any radiological contamination. In the case of liquid spills such as hydraulic fluid, motor oil, diesel fuels, decontamination liquids, or incidental water, absorbent pads or materials will be used to contain and cleanup the spill. Absorbent materials will be properly packaged and handled. Radiological surveys performed in response to incidental spills will be documented.

Post incidental spill response actions include:

- ensuring the proper reporting per HSP-21.04 and ADM-16.01; and
- conducting a briefing to address the cause of the spill, methods of preventing future spills, and ways to improve readiness and response.

10.1.2 Emergency Spill Operations

Emergency Response Definition:

A response effort by personnel from outside the immediate release area, or by other designated responders to a release that results, or is likely to result, in an uncontrolled release of a hazardous substance.

An emergency response is required in the following situations:

- the responders are not in the immediate response area;
- the release requires emergency evacuation of employees in the area;
- the release poses a serious threat of fire or explosion (NFPA fire hazard rating of 3 or 4);
- the release may cause high levels of exposure to toxic substances; and
- there is uncertainty that the employees in the work area can safely handle the severity of the hazard with the available PPE and equipment.

Emergency Spill Response Actions

- immediately notify coworkers in the area and depending on the severity of the spill sound the appropriate air horn alarm indicating a controlled or immediate evacuation;
- notify the Field Operations Deputy Project Manager;
- isolate the area to prevent vehicle traffic through the area and minimize personnel exposures;
- call 2911 or use radio channel 2911 and provide them with the following information:
  - exact location of the spill;
  - type of spill;
  - volume of the spill; and
  - time of the spill.
- if a controlled evacuation:
  - all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
  - all depleted uranium will be placed in a fire-safe configuration via inerting; and
  - once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;
- notify Air Quality Management of potential unexpected release;

Post emergency spill response actions include:

- ensuring the proper reporting per HSP-21.04 and ADM-16.01; and
- conducting a briefing to address the cause of the spill, methods of preventing future spills, and ways to improve readiness and response.

10.2 ACCIDENT/INJURY

In the event of an accident or other event that causes serious injury to personnel at the Trench1 project, the RFETS emergency extension at **2911** will be notified immediately. The site Fire Department, EMTs, and Security will be dispatched immediately. Details of the medical emergency and the exact location must be given over the phone. Basic first aid may be administered by properly trained personnel until emergency medical personnel arrive.

10.2.1 Emergency Medical Procedures

For severe injuries, illnesses, or overexposures the following actions will be taken:

- remove the injured or exposed person(s) from immediate danger if safe to do so;
- immediately call extension 2911 and provide as much information as possible;
- notify the Field Operations Deputy Project Manger and the Field Supervisor;
- if the injured person is wearing a SCBA and cannot be removed from the area, the following actions will be taken:
  - a portable SCBA air cylinder equipped with a airline hose or a Supplied Air Respirator (SAR) airline will be immediately located near the individual;
  - a RCT will survey the airline connection on the injured individuals SCBA regulator;
  - if the SCBA cylinder alarm on the injured person sounds, the portable SCBA cylinder or the SAR will be plugged into the individuals regulator;
  - additional portable SCBA air cylinder will be used as required; and
  - assist the emergency response personnel as directed.
- **NOTE: If the injured person is not breathing, they will be immediately relocated to an area where rescue breathing may be administered.**
- if the injured person can be removed from the work area, at least partial decontamination should be attempted. Remove protective equipment and clothing and redress the victim in clean coveralls or wrap in a blanket;
- if decontamination cannot be done, wrap the victim in blankets or plastic sheeting to reduce contamination of other personnel. **Information regarding contamination will be relayed to emergency medical response personnel;**
- render emergency first aid until emergency medical response personnel arrive;
- assist emergency medical personnel as directed; and
- conduct a controlled evacuation after placing all depleted uranium in a fire-safe configuration.

10.3 FIRE/EXPLOSION

Regardless of the type of fire, the following actions will be taken:

- immediately notify coworkers in the area and depending on the severity of the fire sound the appropriate air horn alarm indicating a controlled or immediate evacuation;
- notify the Field Operations Deputy Project Manager;
- notify the Rocky Flats Fire Department at phone extension or radio channel 2911;
- if a controlled evacuation;

- all nonessential personnel will exit the temporary structure by normal egress routes and relocate to a safe upwind assembly area (***No personnel will be allowed to leave the assembly area.***);
- all depleted uranium will be placed in a fire-safe configuration via inerting;
- once the temporary structure is secured and the depleted uranium is in a fire-safe configuration, remaining personnel will exit the temporary structure;

Note: Only personnel trained in the use of Dry Chemical and Met-L-X fire extinguishers will be permitted to extinguish a fire and under no circumstances should anyone attempt to fight a fire alone.

If the fire type is Class A, or B, or C, the following actions will then be taken:

- if it can be safely done, attempt to extinguish the fire with a Dry Chemical fire extinguisher; and
- if the fire involves electrical equipment and if it can be done safely, shut of power to the equipment.

In the event of a depleted uranium fire, the following actions will then be taken:

Caution

Due to the potential for a steam explosion, water <u>WILL NOT</u> be used to extinguish a depleted uranium fire

- if it can be safely done, attempt to extinguish the fire with a Met-L-X fire extinguisher; and
- if the fire is in the trench, the excavator operator will cover the burning metal with soil.

In the event of an explosion, all personnel will be immediately evacuated and the fire department notified. No personnel shall re-enter the area until it has been cleared by the Rocky Flats Fire Department.

10.4 EXCAVATION EMERGENCIES

The excavation at the Trench 1 project will be vertical walled with no shoring and is not configured for personnel entry. If a person falls into the open excavation, the following actions will be taken:

- immediately call extension 2911 and provide as much information as possible; and
- notify the Field Operations Deputy Project Manger and the Field Supervisor.

If authorized by the competent person in charge of inspecting the excavation conduct the following:

- place a ladder into the excavation;
- if the person in the excavation is uninjured, they will use the ladder and exit the excavation;
- if the injured person is wearing a SCBA or PremAire airline respirator and cannot extricate themselves, the following actions will be taken:
  - a portable SCBA air cylinder equipped with a airline hose or a Supplied Air Respirator (SAR) airline will be immediately located near the individual;
  - if the SCBA cylinder alarm on the injured person sounds or the air supply hose to the PremAire user is damaged, the portable SCBA cylinder or the SAR airline will be plugged into the individuals SCBA regulator or PremAire manifold;
  - additional portable SCBA air cylinders will be used as required; and
  - assist Fire Department personnel as directed.
- if the injured person is wearing a full-face air-purifying respirator and cannot extricate themselves, the following actions will be taken:
  - do not enter the trench unless the injury is life threatening;
  - assist Fire Department personnel as directed; and
- conduct a controlled evacuation after placing all depleted uranium in a fire-safe configuration

10.5 SCBA/AIRLINE RESPIRATOR EMERGENCIES

In the event that the air supply to a PremAire™ airline respirator fails, or a regulator on any Supplied Air Respirator malfunctions, the following actions will be taken:

- if the air supply to a person wearing a PremAire™ airline respirator fails, the user will open their emergency escape bottle and exit the temporary structure following normal egress routes;
- if a PremAire™ airline respirator user does not receive air at the facepiece upon opening their emergency escape cylinder, they will immediately exit the temporary structure via the nearest exit;
- if a SCBA user does not receive air at the facepiece during normal operation, they will open their emergency bypass valve and exit the temporary structure following normal egress routes;
- if a SCBA user does not receive air at the facepiece upon opening their emergency bypass valve, they will immediately exit the temporary structure via the nearest exit;
- conduct a controlled evacuation after placing all depleted uranium in a fire-safe configuration

10.6 NATURAL DISASTERS

Natural disasters may occur at the site and include lightning strikes, high winds, and tornados. Personnel shall follow the appropriate work limitations and sheltering requirements communicated over the Life Safety Disaster Warning System (LS/DW) or by HSS/SSOs during these natural disasters.

Project Phone List

Name	Company/Title	Phone	Pager	Radio	Home
Aldridge, Steve	RMRS - Health and Safety Specialist	4183	508-2137	3719	
Barbour, Don	Starmet - Project Manager	4518	-	EMAD6	
Barnes, Dave	RTG - Health and Safety Specialist	5352	3542	3748	
Barroso, Jeff	RMRS - Radiological Engineering	8451	5888	Site Surv	
Bemski, Mike	RMRS - Field Supervisor	4090	212-6271	3805	
Boyle, Jim	DOE - Facility Representative	9742	1-888-290-8786		
Burmeister, Mark	RMRS - Deputy Project Manager	5891	212-6228	-	
Casteneda, Norma	DOE - ER Projects	4226	4466	-	
Chandler, Skip	RMRS - H&S Team Leader	6673	1659	3806	
Cygnarowicz, Robert	RMRS - Project Support	7916	6143	-	
Cirillo, Russ	RMRS - Bldg. 891 Water Treatment	5876	4011	3765	
Cochran, Noelle	Starmet - Quality Assurance Officer	4518	-	EMAD6	
Coyne, Dan	RMRS - Maintenance	8177	7223	3411	
Demos, Nick	RMRS - Project Support	4605	212-6159	3810	
DeWitt, Stephanie	KH - IH&S Oversite	4750	8083	-	
DiGregorio,Greg	RMRS - Quality Assurance	5688	212-6206	-	
Farler, David	RMRS - H & S Supervisor	4340	5248	3743	
Findley, Michael	RMRS - Vice President ESH&Q	2653	5978	3763	
Garland, Kevin	RMRS - Radiological Safety Technical Manager	4310	7074	3277	
Gillen, Bill	KH - Senior Technical Advisor	2247	212-1974	-	
Gillespie, Ken	RMRS - Site Safety Officer	5356	4007	3733	
Greengard, Tom	KH - Program Manager	5635	212-1968	-	
Guild, Randy	Dyncorp - Contractor Yard	5302	6151	3811	
Hull, Kurt	Starmet - Assistant Project Supervisor	4518	-	EMAD6	
Jean-Perrin, Janelle	Radian, Air Quality	5483	-	-	
Jenkins, Ken	RMRS - H&S Team Leader	5374	7455	4505	
Kirar, John	RMRS - Nuclear Safety	7844	7577	-	
Langsted, Jim	RMRS - Health Physicist	2542	3425	-	
Law, John	RMRS - Director, Environmental Rest.	4842	4564	-	
Lenarcic, Ken	KH - Transportation	2377	1780	-	
Lindsey, Tom	RMRS - Project Support	5705	212-5681	3757	
Lombardo, Nick	Starmet - Project Supervisor	4518	859-0751	EMAD6	
Lopez, Steve	Starmet - Health and Safety/Quality	4518	-	EMAD6	
Luker, Steve	RMRS - Quality Assurance	7291	-	-	
Martin Lewis, Sally	RMRS - Technical Support	6643	7333	-	
Mattheiss, Mark	RMRS - Radiological Coordinator	4719	475-2535	3271	
McCafferty, Ruth	RMRS - Industrial Hygiene	2244	3373	3794	
Miller, John	RMRS - Radiological Engineer	2454	7981	-	
Mobley, Steve	KH - Excavation Specialist	2538	212-5502	4508	
Myrick, Susan	RMRS - Field Supervisor	5051	4343	-	
Nims, Debra	Starmet - Health and Safety Program Manager	4518	-	EMAD6	
Omberg, Susan	RFETS Fire Protection Engineering	6294	1961	-	

Name	Company/Title	Phone	Pager	Radio	Home
Parker, Timothy	Rocky Flats Fire Department - Fire Chief	6043	3706	2001	
Parson, Gary	KH - Excavation Specialist	4197	212-5508	4561	
Pepping, Mike	RMRS - Waste Generator	3075	212-6331	3808	
Peters, Mike	RMRS - Quality Assurance	5884	-	-	
Primrose, Annette	RMRS Field Operations Manager	4385	212-6338	3801	
Russell, Wade	RTG - Health and Safety Specialist	5356	6136	3728	
Salomon, Hopi	RMRS - Sample/Waste Manager	6627	212-6224	3779	
Schreckengast, Peggy	RMRS - H&S Supervisor	6790	3059	3702	
Spence, Tracey	RMRS - Field Supervisor	4322	6152	3812	
Sproles, Wayne	RMRS - Project Manager	5790	212-5651	3711	
Wagner, Rick	RMRS - Project Operations	3102	212-6363	3798	
Wood, Mark	RMRS - Project Support	6689	5904	3755	
Watson, Bruce	RMRS - Radiation Control Compliance	2627	7513	-	

APPENDIX B

ACTIVITY HAZARD ANALYSES

TRENCH 1 SOURCE REMOVAL

GENERAL PROJECT HAZARDS

Activity Hazard Analysis

2-28-98

Activity	Hazard	Preventative Measures
All site activities	Unauthorized, untrained, or unprotected personnel in the work area	Visitors entering the work area will sign in at the access control point and notify the Field Operations Deputy Project Manager who will arrange for an Orientation Tour.
	General work hazards in the support zone	Personnel in the support zone, west and south of the trailers, will wear safety shoes, safety glasses with side shields, hard hats, and orange vests.
	Heat stress	Real-time heat stress monitoring will be conducted in regards to work load and PPE worn and administrative controls will be adhered to.
	Cold stress	Cold stress monitoring will be conducted in the work area. Proper clothing will be available to personnel and administrative controls will be adhered to.
	Noise	Real-time noise monitoring will be conducted in the work area to characterize operations and delineate areas where postings and hearing protection is required. In addition, noise dosimetry will be conducted when the 8-hour time weighted average (TWA) is suspected to be greater than 85 dBA. Should the 8-Hour TWA be greater than 85 dBA, personnel shall be required to participate in a Hearing Conservation Program.

Activity	Hazard	Preventative Measures
All site activities (cont.)	Slip, trips, falls	Care will be taken when traversing the site especially when wearing PPE and carrying equipment. All trip hazards will be immediately removed or clearly marked when identified.
	Poor communications due to PPE ensemble and background noise	Personnel will not conduct work activities which could impact/injure collocated workers without clearly communicating the work hazards with the collocated workers
	Inadequate lighting in work areas	A minimum of 5 footcandles will be maintained in the work areas while work is in progress.
Lifting equipment and materials	Back or other injuries resulting from improper lifting	Proper lifting techniques will be used. When feasible, heavy equipment will be utilized to move heavy loads.
Handling equipment and materials	Pinch points and sharp edges	Care will be taken when pinch points and sharp edges exist and heavy duty leather work gloves will be worn.
Using hand tools	Hand tools in unsafe operating condition	Hand tools will be inspected by the user prior to each use.
	Improper use of hand tools	Hand tools will be utilized for their intended use and operated in accordance with HSP-12.10. Guards will be in place and no modifications will be made.
	Electrical shock	Portable power tools will be plugged into a GFCI protected outlet and will be UL listed with a three wire grounded plug or be double insulated. Cords will be inspected by the user and protected from unnecessary damage. Any tool whose cord shows signs of damage or deterioration will be immediately tagged out of service.

Activity	Hazard	Preventative Measures
Use of generators	Electrical shock	Extension cords will be intended for outdoor use, inspected by the user, and protected from unnecessary damage. Any extension cords which show signs of damage or deterioration will be immediately tagged out of service.
	Electrical shock	Cords will be plugged into a GFCI protected outlet and the generator will be properly grounded. The GFCI will be tested by the user daily prior to the beginning of each shift.
	Fire	At a minimum, a 10 lb. ABC fire extinguisher will be located next to the generator. All refueling will be conducted at the beginning of the shift when the generators are cool.
	Use of gasoline	Follow recommendations on MSDS .
Heavy Equipment operations	Heavy equipment in poor operating condition	Heavy equipment will be inspected prior to entering RFETS. The operators will inspect heavy equipment prior to the beginning of each shift. Theses inspections will be documented.
	Improper operation of heavy equipment	Operators will be properly trained in the use and limitations of the heavy equipment.

Activity	Hazard	Preventative Measures
Heavy Equipment operations (cont.)	Ground personnel being struck with heavy equipment or falling loads	Ground personnel will wear orange vests, or equivalent, and stay away from heavy equipment . Should ground personnel need to approach heavy equipment, the spotter will be notified, the operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that personnel may approach. Particular attention will be payed to the swing path of the trackhoe counterweight. Back up alarms will be confirmed operational. At no time will personnel position themselves under hydraulically operated equipment.
	Other equipment being struck with heavy equipment	Heavy equipment operations will be conducted in a deliberate safe manner. A spotter will be required when backing heavy equipment during non routine operations.
	Fire or spill during refueling of heavy equipment in the temporary structure	Refueling of heavy equipment will be conducted in accordance with Operations Order No. 00-T1-06, *Refueling of Heavy Equipment Within the Temporary Structure.*
Activities within the Radiological Buffer Area/Contamination Reduction Zones (RBA/CRZs)	General work hazards in the RBA/CRZs	Personnel will wear hard toed safety shoes, over the shoulder DOE coveralls, and safety glasses with side shields.
	Spread of radiological contamination	Materials will be surveyed prior to entering the RBA/CRZs from CA/EZ. Personnel will be frisked at the outer step-off pad. RBA/CRZ contamination control surveys will be conducted daily.

Activity	Hazard	Preventative Measures
Activities within the Radiological Buffer Area/Contamination Reduction Zones (RBA/CRZs)	Skin exposure to radionuclides and chemicals of concern	Adherence to PPE doffing guidelines will be enforced. Radiological Control Technicians (RCT's) will wear surgeon gloves when frisking personnel.
	Inhalation of radionuclides	CAMs will be operated in the CA/EZs immediately adjacent to the RBA/CRZs
	Inhalation of chemicals of concern	Potential chemical exposures will be controlled by assuring that negative pressure is maintained through the RBA/CRZs. Real-time air monitoring for Volatile Organic Compounds (VOC's), carbon monoxide, nitric oxide, nitrogen dioxide, sulfur dioxide, hydrogen cyanide, and particulates will be conducted to characterize the work areas
Activities within the High Contamination Area and Contamination Areas (HCA/EZ and CA/EZ)	General work hazards in the HCA/EZ and CA/EZs	In addition to the Personal Protective Equipment (PPE) stipulated on the Radiological Work Permit, personnel will wear hard toed safety shoes. Orange vests, or equivalent, will be required for personnel in the HCA/EZ and CA/EZs (excluding inside the vestibules).
	Spread of radiological contamination	Materials will be surveyed prior to exiting the HCA/EZ and CA/EZs. Personnel will be frisked at the outer step-off pad. HCA/EZ and CA/EZs contamination control surveys will be conducted daily.
	Skin exposure to radionuclides and chemicals of concern	Personnel will wear personal protective clothing and limit contact with contaminated material. Adherence to PPE doffing guidelines will be enforced.

Activity	Hazard	Preventative Measures
Activities within the High Contamination Area and Contamination Areas (HCA/EZ and CA/EZ)	Personnel contact with depleted uranium	Personnel will minimize the direct handling of depleted uranium. If direct handling is required, personnel shall use tools such as tongs, shovels, or scoops as much as possible and wear lead loaded gloves.
	Inhalation of radionuclides	Personnel will wear Level B or C respiratory protection. Potential exposures will be characterized through the use of high and low volume radiological air samples.
	Inhalation of chemicals of concern	Personnel will wear Level B respiratory protection during actual excavation activities. Depending on the results of real-time chemical air monitoring, Level C respiratory protection may be worn during periods of no excavation.
	External radiation	Material removed from the trench, except soil not containing or suspected of containing depleted uranium, will be immediately characterized for both beta and gamma radiation. In addition, EPDs will be used to track daily radiation doses and will alarm at 2 mrad/hr.
	Inhalation of chemicals of concern in the vestibule CA/EZs	Airflow through the vestibules should allow for no respiratory protection. Depending on the results of real-time chemical air monitoring, Level B respiratory protection may be required.
	Inhalation of radionuclides of concern in the vestibule CA/EZs	Full-facepiece air-purifying respirators will be worn and CAMs will be operated in the vestibule CA/EZs.
Use of Level B or Level C respiratory protection	Physical fatigue	Medical approval will be required for personnel.

Activity	Hazard	Preventative Measures
Use of Level B or Level C respiratory protection (cont.)	Improper face to facepiece seal	Respirator specific fit test approval will be required for personnel.
	Improper inspection, use or storage of respirator	Personnel will be trained in the inspection, use, storage, and limitations of the specific respirator worn.
Use of heavy equipment mounted breathing air cylinders for Level B respiratory protection	Unsecured airline bottles on heavy equipment	Heavy equipment mounted airline bottles will be inspected by the operator prior to and periodically during each shift.
Use of personal protective equipment (PPE)	Potential radiological or chemical contamination due to defective PPE	Personnel shall inspect PPE for defects prior to donning.
	Potential radiological or chemical contamination due to damaged PPE or improper doffing	When in the field it is the responsibility of each individual to periodically inspect their own PPE and the PPE of coworkers. PPE will be doffed in accordance with posted doffing guidelines and RCT instructions
Working around open trench	Sloughing of trench walls	The trench will be inspected by a competent person (HSS) daily prior to and during each shift. The excavation will also be inspected after any hazard increasing event
	Slips, trips, falls into trench	A warning system will be established and personnel will stay a minimum of six feet away from the edge of the trench. Personnel closer than six feet must wear a full body harness and lifeline attached to an approved anchorage point. In addition, if personnel wear a full-body harness and lanyard, they will have current Fall Protection Awareness training.
	Equipment falling into trench	All equipment, except the excavator, will be kept a minimum of two feet away from the edge of the trench.

Activity	Hazard	Preventative Measures
Drum handling	Back or other injury due to overexertion or improper manual drum handling techniques	It is imperative to stage drums in a manner which allows for access by the fork lift/drum grabber. If a drum must be manually moved so that the fork truck can gain access, the following controls will be employed: • footing surfaces will be free of slip hazards such as water or oil and the path of travel will be free of trip hazards; • hands will be placed at approximately ten and two o'clock; • pinch points will be identified and removed if possible; • personnel will position themselves so that their backs are straight and knees are slightly bent; • the drum will be slowly tilted so that the tipping point is not exceeded; • if the drum is too heavy to be easily tipped, personnel will not attempt to tilt the drum using jerking motions which could lead to back injury and will request help from additional personnel; and • hands will be slid along the drum ring in a manner which prevents the crossing over of arms.
Spraying water for dust control and pumping decontamination or incidental water into the holding tanks or into tanker trucks	Pump malfunction or hose rupture	Pumps and hoses will be inspected by the user prior to use. The hoses will be protected from unnecessary damage. The discharge end of the incidental water hose will be submerged in the holding tank. Tankers will be filled in accordance with their safety guidelines.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne RS	4/29/98
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RMRS Radiological Engineer-John Miller	John Bottenberg	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT

EXCAVATION OF DRUMS, SOIL, DEBRIS, UNKNOWN MATERIAL AND SUSPECTED CLASSIFIED ITEMS

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Excavating drums, soil debris, unknown material, and suspected classified items	Explosion or fire due to hydrogen build up when excavating and piercing drums.	Drums will be pierced with a trackhoe mounted non-sparking tool prior to removal from the excavation. Personnel in the work area will relocate to predetermined locations prior to piercing drums.
	Unexpected hazards or conditions	A spotter will be present during all excavation activities. Material removed from the trench will be initially characterized as follows: • Visual inspection • Heat testing • Radiation survey • Combustible gas monitoring • VOCs • Radiological contamination survey • pH of liquids
Conducting initial radiological and industrial hygiene characterization at the trackhoe bucket	Ground personnel being struck with trackhoe	A spotter will be in constant contact with the operator and all ground personnel communications with the operator will go through the spotter. Prior to personnel approaching the bucket, the operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that personnel may approach.

Activity	Hazard	Preventative Measures
Handling of depleted uranium prior to inerting at the Sampling and Inerting Pad (SIP)	Depleted uranium fire	To provide an indication of rapid oxidation, temperature measurements of depleted uranium will be obtained in accordance with Operations Order No. 00-T1-09, *Temperature Measurements of Depleted Uranium at the Trench 1 Source Removal Project*.
	Personnel contact with depleted uranium	Personnel will minimize the direct handling of depleted uranium. If direct handling is required, personnel shall use tools such as tongs as much as possible and wear lead loaded gloves.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
RMRS H&S Supervisor-Dave Farler	David F Farler	4/29/98
RMRS Radiological Engineer-John Miller	[illegible]	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT
SEGREGATION AND PACKAGING OF DRUMS, SOIL, DEBRIS, UNKNOWN MATERIAL, OR SUSPECTED CLASSIFIED ITEMS
Activity Hazard Analysis
2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Segregation of material	Personnel contamination and sharp edges	The trackhoe will be used whenever possible. If personnel must handle material, remote handling devices will be utilized to the extent feasible and heavy duty leather gloves will be worn.
Placing soil in the front-end loader bucket	Equipment damage	The front-end loader will be stationary when loading directly from the trackhoe bucket
Hoisting intact drums into overpack containers	Failure of rigging equipment	A Lifting Plan (Appendix D) has been developed and a hoisting and rigging checklist will be completed per HSP- 12.02, *Hoisting and Rigging*. Rigging equipment will be properly tagged and certified. In addition, the rigging equipment will be inspected by the user prior to use on a daily basis.

Activity	Hazard	Preventative Measures
Hoisting intact drums into overpack containers (cont.)	Failure of drum resulting in falling load or spill.	The drum will be visually inspected to ensure that it has enough structural integrity for hoisting. The lift will be initiated by tensioning the rigging equipment and lifting the drum approximately 2" to evaluate the structural integrity of the drum. If hoisting of the drum is to be conducted based on the tensioning evaluation, personnel in the area shall relocate to a safe distance until the drum is placed in the overpack.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
RMRS H&S Supervisor-Dave Farler	David F Farler	4/29/98
RMRS Radiological Engineer-John Miller	John Bittenbender	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT

TRANSPORTING MATERIAL TO THE

SAMPLING AND INERTING PAD (SIP)

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Transport of containers to the Sampling and Inerting Pad (SIP)	Spills of soil or liquids	Lids will be placed on containers prior to transport and the fork lift operator will drive with caution.
	Spread of radiological contamination	Gross decontamination will be conducted on waste packages prior to transport and the fork lift will travel on established roadways.
Placing lids on containers	Pinch points resulting in injury or PPE damage and potential contamination	Personnel will wear heavy duty leather gloves and pay particular attention to pinch points. Two workers will be utilized to place lids on large containers.
Fork lift operations	Fork lift in poor operating condition	The operator will inspect the fork lift prior to the beginning of each shift. This inspections will be documented per HSP-9.06 *Powered Industrial Trucks*.
	Improper operation of the fork lift	The fork lift operator will possess a current Fork Truck Operators Permit per HSP-9.06
	Ground personnel being struck with fork lift	Fork lift operating areas will be established and personnel will remain clear of these areas.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
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TRENCH 1 SOURCE REMOVAL PROJECT

SAMPLING AND INERTING PAD (SIP) OPERATIONS

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Receiving material at the SIP	SIP personnel unaware of the hazard associated with the material being received	Results of the initial characterization will be provided to SIP personnel. SIP personnel will visually inspect the materials and additional characterization will be conducted as needed.
Removing lids	Explosion or fire due to hydrogen buildup	SIP personnel will ensure that no explosive levels of hydrogen are present by confirming initial characterization or taking additional explosive gas readings.
	Use of hand tools and sharp edges	Hand tools will be used in accordance with the General Project Hazards AHA and personnel will wear heavy duty leather gloves
Sampling of liquids or solids	Material to be sampled incompatible with sample preservatives such as sulfuric acid.	Material to be sampled will be evaluated for compatibility with the sample preservative. For instance, oil should not be mixed with a strong acid.
	Handling of depleted uranium	Sampling of depleted uranium will be done using scoops and other tools. Lead lined gloves will be worn as determined by Radiological Engineering.
	Splashing of liquids	If a splash hazard exists and cannot be mitigated, polycoated coveralls or aprons will be worn.

Activity	Hazard	Preventative Measures
Removing liquids from waste packages with pumps and placing into containers	Failure of pumps or hoses resulting in personnel contamination or spill.	Handling of liquids will be conducted within a secondary containment and pumps and hoses will be inspected by the user prior to use.
	Mixing of incompatible liquids	SIP personnel will ensure that liquids are compatible prior to mixing.
	Splashing of liquids	If a splash hazard exists and cannot be mitigated, polycoated coveralls or aprons will be worn.
Removing debris from waste packages such as drum fragments	Personnel contamination and sharp edges	Remote handling devices will be utilized to the extent feasible and heavy duty leather gloves will be worn.
Pumping mineral oil into overpack containers	Failure of pumps or hoses resulting in personnel contamination or spill	Handling of liquids will be conducted within a secondary containment and pumps and hoses will be inspected by the user prior to use.
	Fire due to ignition of mineral oil by burning depleted uranium	Temperature measurements of the depleted uranium will be obtained just prior to inerting with mineral oil.
Placing lids on containers	Pinch points resulting in injury or PPE damage and potential contamination	Personnel will wear heavy duty leather gloves and pay particular attention to pinch points. Two workers will be utilized to place lids on large containers.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
RMRS H&S Supervisor-Dave Farler	David J Farler	4/29/98
RMRS Radiological Engineer-John Miller	John Whitsett	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT

TRANSPORT OF SOIL TO AND MANAGEMENT OF THE SOIL STOCKPILE

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Front-end loader operations	Front-end loader in poor operating condition	The operator will inspect the front end loader prior to the beginning of each shift. These inspections will be documented.
	Ground personnel being struck with front-end loader	Front-end loader operating areas will be established and personnel will remain clear of these areas.
Obtaining radiological or industrial hygiene readings and sampling at the front-end loader bucket	Ground personnel being struck with front-end loader	A spotter will be in contact with the operator and all ground personnel communications with the operator will go through the spotter. Prior to personnel approaching the bucket, the operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that personnel may approach.
Dumping or moving soil	Generation of airborne dust	The operator will carefully dump and move soil. Dust suppression will be conducted as required.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
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RMRS Radiological Engineer-John Miller	A B Stebbins	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT

MANAGEMENT OF WASTE CONTAINER STORAGE AREA

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Transport of containers to and in the Waste Container Staging Area	Spills of soil or liquids	Waste Packages will be sealed prior to transport.
Fork lift operations	Fork lift in poor operating condition	The operator will inspect the fork lift prior to the beginning of each shift. This inspections will be documented per HSP-9.06 *Powered Industrial Trucks*.
	Improper operation of the fork lift	The fork lift operator will possess a current Fork Truck Operators Permit per HSP-9.06
	Ground personnel being struck with fork lift	Fork lift operating areas will be established and personnel will remain clear of these areas.
Placing drums into overpack containers	Failure of rigging equipment	A Lifting Plan (Appendix D) has been developed and a hoisting and rigging checklist will be completed per HSP- 12.02, *Hoisting and Rigging*. Rigging equipment will be properly tagged and certified. In addition, the rigging equipment will be inspected by the user prior to use on a daily basis.
Staging of containers	Unauthorized, untrained, or unprotected personnel in the staging area.	The staging area will be clearly delineated and posted.
	Unknown condition of containers during storage	The staging/storage area will be inspected at the proper intervals

Approved:	Signature	Date
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RMRS Radiological Engineer-John Miller	John R Stabrowski	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT

EXCAVATION VERIFICATION SAMPLING

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Decontamination of trackhoe bucket or sampling equipment	Ground personnel being struck with trackhoe	Prior to personnel approaching the bucket, the trackhoe operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, turn the engine off, and give a hand signal indicating that personnel may approach.
	Skin contact with decontamination fluids	Depending on the type of decontamination, polycoated coveralls or aprons may be worn.
Obtaining samples at the trackhoe bucket	Ground personnel being struck with trackhoe	A spotter will be in constant contact with the operator and all ground personnel communications with the operator will go through the spotter. Prior to personnel approaching the bucket, the trackhoe operator will set the bucket on the ground, disengage the hydraulic system, set the parking brake, and give a hand signal indicating that personnel may approach.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
RMRS H&S Supervisor-Dave Farler	David J Farler	4/29/98
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TRENCH 1 SOURCE REMOVAL PROJECT

SURVEY/DEPOST TEMPORARY STRUCTURE

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Aerial manlift operations when surveying tent interior	Aerial lift in poor operating condition	The operator will inspect the aerial lift in accordance with HSP-22.06 *Work Platforms*
	Improper operation of aerial manlift	Operators will have current Aerial Lift training per HSP-22.06.
	Aerial lift falling into the excavation	A warning system will be established at least six feet from the excavation. A spotter will be positioned on the ground if necessary.
	Personnel falling out of manlift	Personnel will wear full-body harness with a lanyard attached to an anchorage point approved by RMRS health and safety. In addition, personnel will have current Fall Protection Awareness training.
Use of ladders to access elevated areas	Ladders in poor condition	Ladders will be inspected by the user prior to use
	Improper use of ladders	Users will have current Ladder Safety Awareness training

Activity	Hazard	Preventative Measures
Elevated work areas when surveying equipment such as the trackhoe	Slips, trips, or falls	Work on unprotected elevated surfaces >6' will be conducted in a full-body harness with a lanyard attached to an anchorage point approved by RMRS health and safety. In addition, personnel will have current Fall Protection Awareness training.
	Failure of fall arrest equipment	Fall arrest equipment will be inspected by the user prior to use

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
RMRS H&S Supervisor-Dave Farler	Dave F Farler	4/29/98
RMRS Radiological Engineer-John Miller	John R Miller	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT

SOIL TRANSPORT AND BACKFILL

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Front-end loader operations	Front-end loader in poor operating condition	The operator will inspect the front end loader prior to the beginning of each shift. These inspections will be documented.
	Ground personnel being struck with front-end loader	Front-end loader operating areas will be established and personnel will remain clear of these areas.
Dumping or moving soil	Generation of airborne dust	The operator will carefully dump and move soil. Dust suppression will be conducted as required.

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
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TRENCH 1 SOURCE REMOVAL PROJECT

SITE RECLAMATION

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Using fork lift to move poly tanks, pumps, generators, jersey barriers and other equipment	Fork lift in poor operating condition	The operator will inspect the fork lift prior to the beginning of each shift. This inspections will be documented per HSP-9.06 *Powered Industrial Trucks*.
	Improper operation of the fork lift	The fork lift operator will possess a current Fork Truck Operators Permit per HSP-9.06
	Ground personnel being struck with fork lift	Fork lift operating areas will be established and personnel will remain clear of these areas.
Removing fence posts, ground rods, or equipment hold downs with chains, slings, and fork lift	Failure of slings or chains	Personnel will remain clear of slings and chains when removing items from the ground
Mixing and applying ConCover®	Inhalation of silica	A full-facepiece air-purifying respirator will be worn when mixing the ConCover®. Respirator wearers will be medically cleared, trained, and fit to the respirator being worn. Personnel not wearing respirators will stay at least 20' away from mixing operations.
	Contact with mixing blades	Personnel will not reach into the machine at any time.
	Injury from high pressure spray	At no time will the nozzle be pointed at any body part or other personnel.

Activity	Hazard	Preventative Measures
Mixing and applying ConCover® (cont.)	Falls from the unit during transport	Operators will ride only in the approved area while in transport and the restraint devices will be in place

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
RMRS H&S Supervisor-Dave Farler	David T Farler	4/29/98
RMRS Radiological Engineer-John Miller	John Estabrooks	4/29/98

TRENCH 1 SOURCE REMOVAL PROJECT

DECONTAMINATION OF EQUIPMENT

Activity Hazard Analysis

2-28-98

NOTE: This Activity Hazard Analysis is to be used in conjunction with "Trench 1 Source Removal Project General Project Hazards" Activity Hazard Analysis.

Activity	Hazard	Preventative Measures
Decontamination of equipment	Skin contact with decontamination fluids	Polycoated Tyvek® will be worn if a splash hazard exists.
	Work with high temperature, high pressure decontamination systems	High temperature, high pressure decontamination will be conducted only by personnel with current Pressure Safety II training. The decontamination system will be inspected prior to use. At no time will the wand be pointed at any personnel. Polycoated Tyvek®, sixteen inch high steel toed rubber boots, safety glasses with face shield, inner and outer nitrile gloves, and hard hat will be worn.
Elevated work areas when decontaminating equipment such as the trackhoe	Slips, trips, or falls	Work on unprotected elevated surfaces >6' will be conducted in a full-body harness with a lanyard attached to an anchorage point approved by RMRS health and safety. In addition, personnel will have current Fall Protection Awareness training.
	Failure of fall arrest equipment	Fall arrest equipment will be inspected by the user prior to use

Approved:	Signature	Date
RMRS Project Manager-Wayne Sproles	Wayne R Sproles	4/29/98
RMRS H&S Supervisor-Dave Farler	David J Farler	4/29/98
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APPENDIX C

HEAT AND COLD STRESS GUIDELINES

RFETS HEAT STRESS PROGRAM

HEAT STRESS GUIDELINES FOR LIGHT WORK

(1)		(2)	(3)	(4)
WORK/REST	WBGT°F	WBGT°F	WBGT°F	WBGT°F
Continuous	86	76	72	68
75/25%	87	77	73	69
50/50%	89	78.5	74.5	70.5
25/75%	90	79.9	75.9	71.9

HEAT STRESS GUIDELINES FOR MODERATE WORK

(1)		(2)	(3)	(4)
WORK/REST	WBGT°F	WBGT°F	WBGT°F	WBGT°F
Continuous	80	70	66	62
75/25%	82	72.4	68.4	64.4
50/50%	85	74.9	70.9	66.9
25/75%	88	77.9	73.9	69.9

HEAT STRESS GUIDELINES FOR HEAVY WORK

(1)		(2)	(3)	(4)
WORK/REST	WBGT°F	WBGT°F	WBGT°F	WBGT°F
Continuous	77	67	63	59
75/25%	78	68.6	64.6	60.6
50/50%	82	72.2	68.2	64.2
25/75%	86	76	72	68

(1) No Personal Protective Equipment
(2) One pair coveralls (Anti C), modesty garments, gloves, hood, shoe covers.... (Level D Haz Mat PPE)
(3) Two pair coveralls (Anti C), modesty garments, gloves, hood, shoe covers....
or
One pair coveralls (Anti C), modesty garments, gloves, hood, respirator. (Level C Haz Mat PPE)
(4) Two pair coveralls (Anti C), modesty garments, gloves, hood, shoe covers, respirator. (Level A&B Haz Mat PPE)

Windchill Index

Wind Speed in mph	ACTUAL THERMOMETER READING (F)									
	50	40	30	20	10	0	-10	-20	-30	-40
	EQUIVALENT TEMPERATURE (F)									
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (little added effect)	LITTLE DANGER (for properly clothed person)				INCREASING DANGER (Danger from freezing of exposed flesh)			GREAT DANGER		

Threshold Limit Values Work/Warm-up Schedule for Four-Hour Shift[a]

Air Temperature—Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm. Breaks) 1		(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	(Norm. Breaks) 1		75min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to -29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

1. Schedule applies to any 4-hour work period with moderate to heavy work activity, with warm-up periods of ten (10) minutes in a warm location and with an extended break (e.g., lunch) at the end of the 4-hour work period in a warm location. For Light-to-Moderate Work (limited physical movement): apply the schedule one step lower. For example, at -35°C (-30°F) with no noticeable wind (Step 4), a worker at a job with little physical movement should have a maximum work period of 40 minutes with 4 breaks in a 4-hour period (Step 5).

2. The following is suggested as a guide for estimating wind velocity if accurate information is not available:
   5 mph: light flag moves; 10 mph: light flag fully extended; 15 mph: raises newspaper sheet; 20 mph: blowing and drifting snow.

3. If only the wind chill cooling rate is available, a rough rule of thumb for applying it rather than the temperature and wind velocity factors given above would be: 1) special warm-up breaks should be initiated at a wind chill cooling rate of about 1750 W/m^2; 2) all non-emergency work should have ceased at or before a wind chill of 2250 W/m^2. In general, the warmup schedule provided above slightly under-compensates for the wind at the warmer temperatures, assuming acclimatization and clothing appropriate for winter work. On the other hand, the chart slightly over-compensates for the actual temperatures in the colder ranges because windy conditions rarely prevail at extremely low temperatures.

4. TLVs apply only for workers in dry clothing.

[a]Adapted from Occupational Health & Safety Division, Saskatchewan Department of Labour.

APPENDIX D

LIFTING PLAN FOR THE OVERPACKING OF INTACT DRUMS

(To be completed when equipment arrives on site)

HSP 12.02

HOISTING AND RIGGING CHECKLIST

Date: 4/28/98 Building or Location: Trench 1 Source Removal Site

Type of Hoisting Activity: ☐ Production ☐ Maintenance ☐ Construction ☒ Other

Description of Work Activity: Overpacking of Depleted Uranium Drums

LIFT DETERMINATION (Is this lift classified as "critical" because of one or more of the following?)

☐ Simultaneous Multi-Hoist Lift ☐ Load Transfer Between Hoists ☒ Potential of Significant Containment Breech

☐ Will the load require exceptional care in handling, because of size, weight, center of gravity, close-tolerance installation.

NOTE: For assistance in making a critical lift determination, contact Health and Safety Area Management.

EVALUATION (Check one of the following based on the criteria listed above.)

☐ Non-Critical ☒ Critical - If checked (✓), explain why: Potential of Significant Drum Breech

Evaluator Kenneth R. Gillespie / K. R. Gillespie Date: 4/28/98
(Print) (Sign)

NOTE: If lift determination is deemed "non-critical", complete the remaining portions of this checklist. If lift determination is deemed "critical" - STOP AND PREPARE a lift plan in accordance with applicable OSHA and ANSI Requirements, and the Department of Energy Hoisting and Rigging Manual.

REQUIREMENTS (To be completed at lift site.)

For non-critical hoisting and rigging activities, this checklist must be completed by the Designated Lift Supervisor and appropriate signatures must be provided. The following are the minimum requirements that shall be considered in the performance of ordinary hoisting and rigging activities. If required, the Designated Lift Supervisor shall be present at the lift site during the entire lifting operation. The Operator and the Designated Lift Supervisor are responsible for ensuring the following criteria are met:

☐ The lift site has been surveyed for hazardous/unsafe conditions, and barricaded appropriately.

☐ A qualified Operator and Signal Person (when required) have been assigned.

☐ A pre-lift meeting has been conducted and the personnel involved understand how the lift is to be made.

☐ The weight of the load has been determined or conservatively estimated, and proper hoisting and rigging equipment is present at the work location.

☐ Hoisting equipment has been properly set-up and positioned.

☐ The Operator has conducted a pre-operational inspection of the hoisting equipment in accordance with applicable standards.

☐ All hoisting and rigging equipment is certified and has been inspected to ensure that the rated capacity of each item shall not be exceeded and is in safe operating condition.

☐ All deficiencies of hoisting and rigging equipment identified during inspection have been corrected.

REMINDER:

The Operator and Designated Lift Supervisor are responsible for the lifting operation. Load lines shall be checked after strain is put on them, before the load is lifted clear of the ground to ensure the lines are plumb and the center of balance is proper. When any potentially unsafe condition is recognized the job shall be immediately stopped.

APPROVALS

Signatures below indicate that the undersigned have verified completion of the checklist criteria stated above.

Qualified Operator _____ / _____ Date: _____
(Print) (Sign)

PBT Operator Hoist Apparatus Training Expiration Date: _____

Designated Lift Supervisor _____ / _____ Date: _____
(Print) (Sign)

RF-48040 (4/94)

LIFTING PLAN

LOCATION Trench / Source Removal Site DATE OF LIFT Multiple

LOAD DESCRIPTION 55 gallon or 83 gallon

LIFT DESCRIPTION Overpacking 55 gallon into 83 gallon

This form to be completed by the crane operator and his supervisor. The purpose of this document is to provide a permanent record of all planning and considerations that will be a part of this lift. All equipment shall be inspected by Construction Safety.

All questions asked on this form are applicable and in accordance with ANSI 30.5 - 1991, PCSA No 2, PCSA No 4, OSHA 1910.180, AND OSHA 1926.550.... and are the law!!

A. FORK TRUCK

1. Type of Fork Truck _____
2. Manufacturer Hyster Company
3. Model Number H135XL2
4. Fork Truck's Capacity 6.75 Tons
5. Equipment Condition
   New ☐ Good ☐ Fair ☐ Poor ☐
6. Certificate of Annual Inspection
   Available in Fork Truck Yes ☐ No ☐
7. Lifting Arrangement:
   a. Max Distance (Center of load to center of pin) _____ Ft.
   b. Length of Boom _____ Ft.
   c. Number of Parts to Boom _____
   d. Angle of Boom at Pickup _____ Degrees
   e. Angle of Boom at Set _____ Degrees
8. Rated Capacity of Fork Truck (From Chart Severiest Lifting Condition)
   a. Over Rear _____ Lbs.
   b. Over Front _____ Lbs.
   c. Over Side _____ Lbs.
   d. Max Capacity of Fork Truck for this Lift(according to chart) _____ Lbs.

B. WEIGHT

1. Weight of Headache Ball _____ Lbs.
2. Weight of Block _____ Lbs.
3. Weight of Lifting Bar _____ Lbs.
4. Weight of Slings & Shackles _____ Lbs.
5. Weight of Jib Erected ☐ Stored ☐ _____ Lbs.
6. Weight of Wire Rope
   Main _____ Lbs.
   Aux. _____ Lbs.
7. Weight of Basket/Platform _____ Lbs.
8. Allowance for Misc. Tools & Materials or 1/2 of Test Weight _____ Lbs.
9. Other: (List)
   _____ _____ Lbs.
   _____ _____ Lbs.
10. Total Weight _____ Lbs.
11. Lift is _____% of Fork Truck's Capacity
12. Source of Load Weight _____
13. Weight verified by _____

C. JIB

1. Jib erected ☐ or stored ☐ (Check one)
2. Will jib be used? Yes ☐ No ☐
3. Length of jib _____ Ft.
4. Angle of jib _____ Degrees
5. Rated capacity of jib _____ Lbs.

D. WIRE ROPE

1. Number of parts to wire rope _____
2. Size of wire rope _____
3. Type of wire rope _____
4. Broken strands in any lay Yes ☐ No ☐

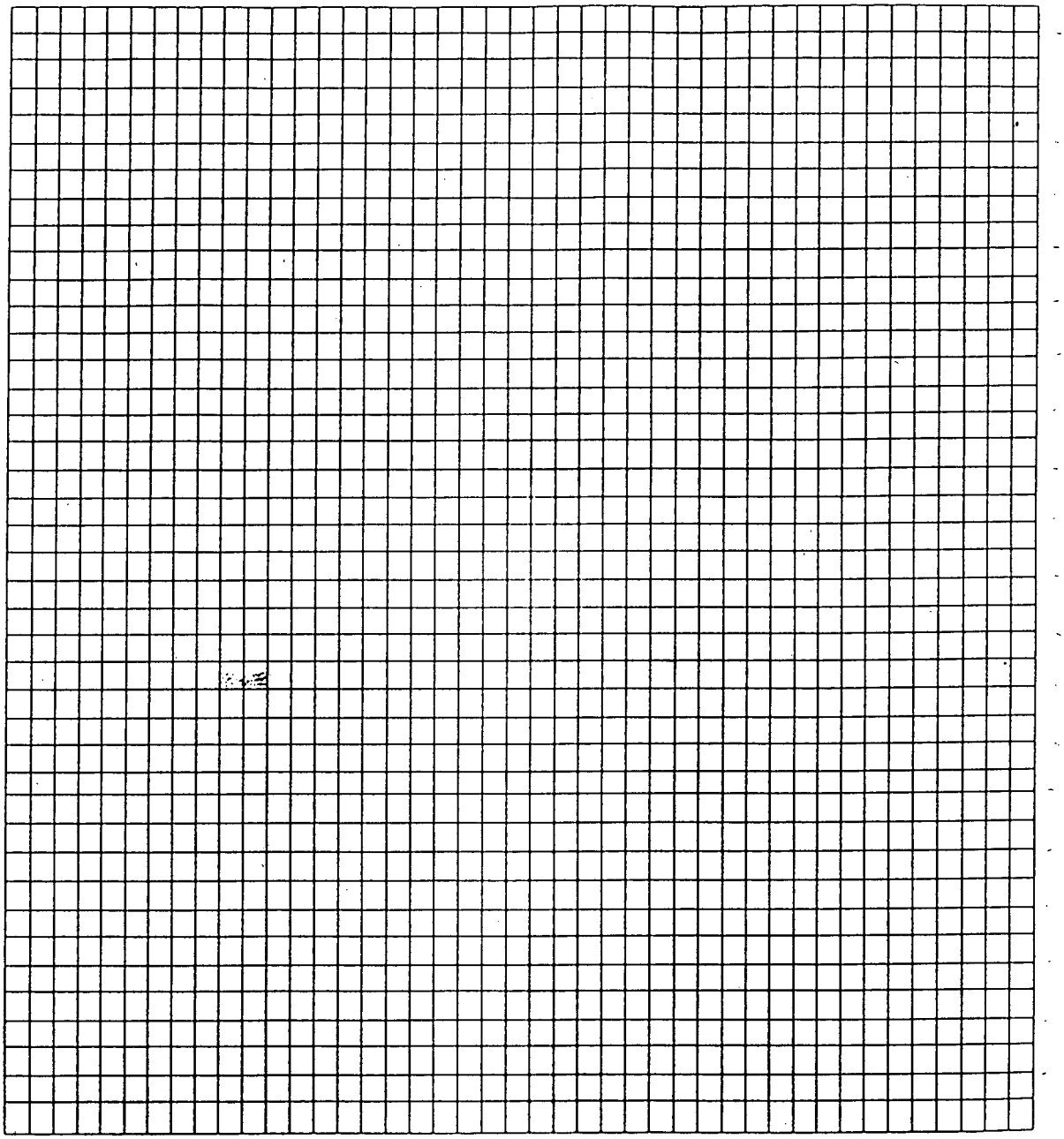
E. SLINGS

1. Sling Selection:
   a. Type of arrangement _____
   b. Number of slings in hookup _____
   c. Sling size _____ Inches
   d. Sling length _____ Inches
   e. Rated capacity of sling _____ Lbs.
2. Shackle Selection
   a. Pin diameter _____ Inches
   b. Capacity (Tons) _____
   c. Number of shackles used _____
   d. Shackle attached to load by: (Name and Title) _____

SPECIAL INSTRUCTIONS OR RESTRICTIONS FOR FORK TRUCK RIGGING, LIFT, ETC.

Diagram of Crane Placement and Rigging Configurations to be completed on back.

DIAGRAM OF CRANE PLACEMENT AND RIGGING CONFIGURATIONS



NOTES:

PREPARED BY _____ DATE _____

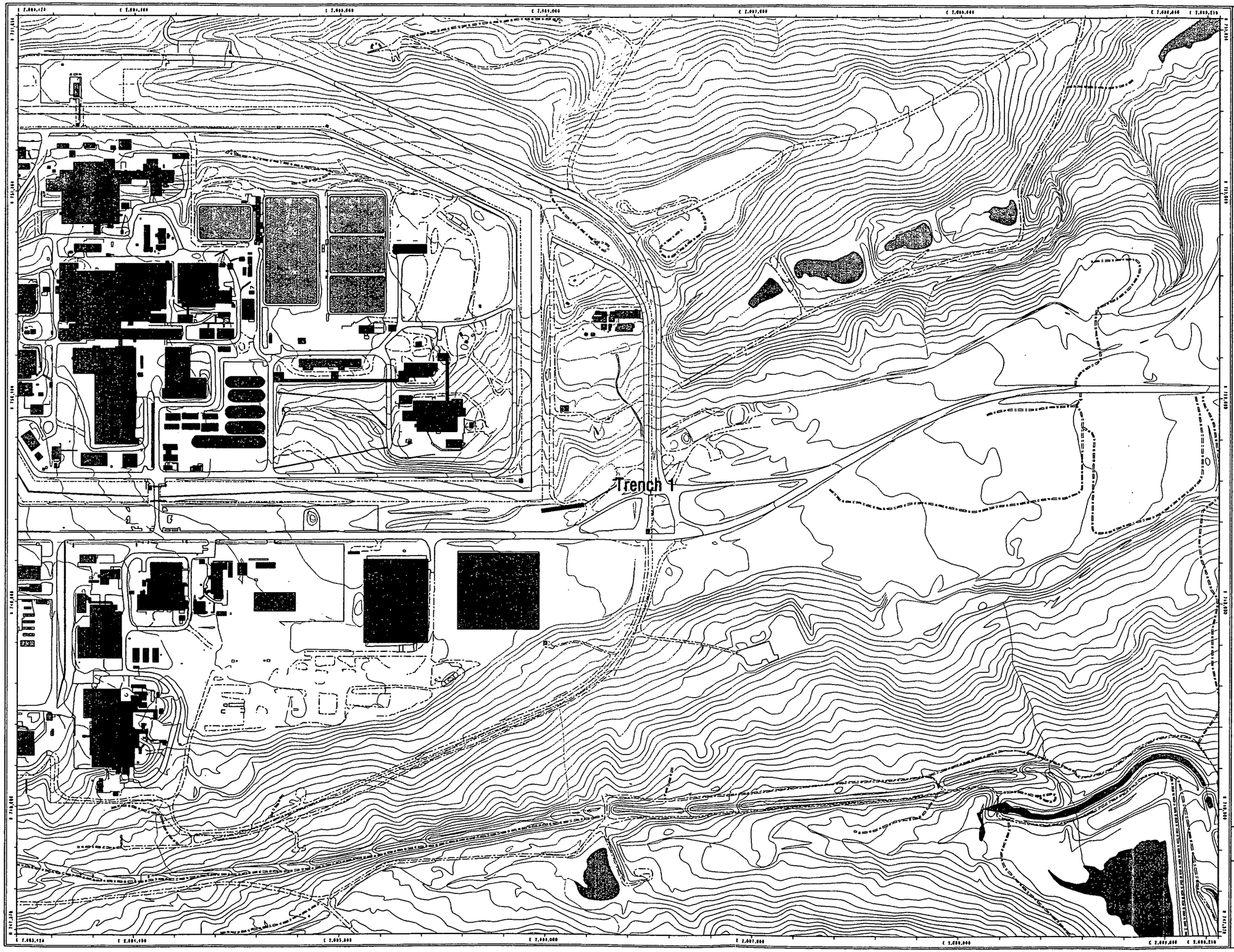


Figure 3.2

Trench 1
Site Location Map

EXPLANATION

Contours (5' intervals)

Trench 1

Standard Map Features

Buildings and other structures

Lakes and ponds

Streams, ditches, or other drainage features

Fences

Paved roads

Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSI, Las Vegas. Digitized from the orthophotographs, 1/96

Scale = 1 : 5430
1 inch represents approximately 453 feet

100 0 200 400 ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: 97-0066

February 25, 1998

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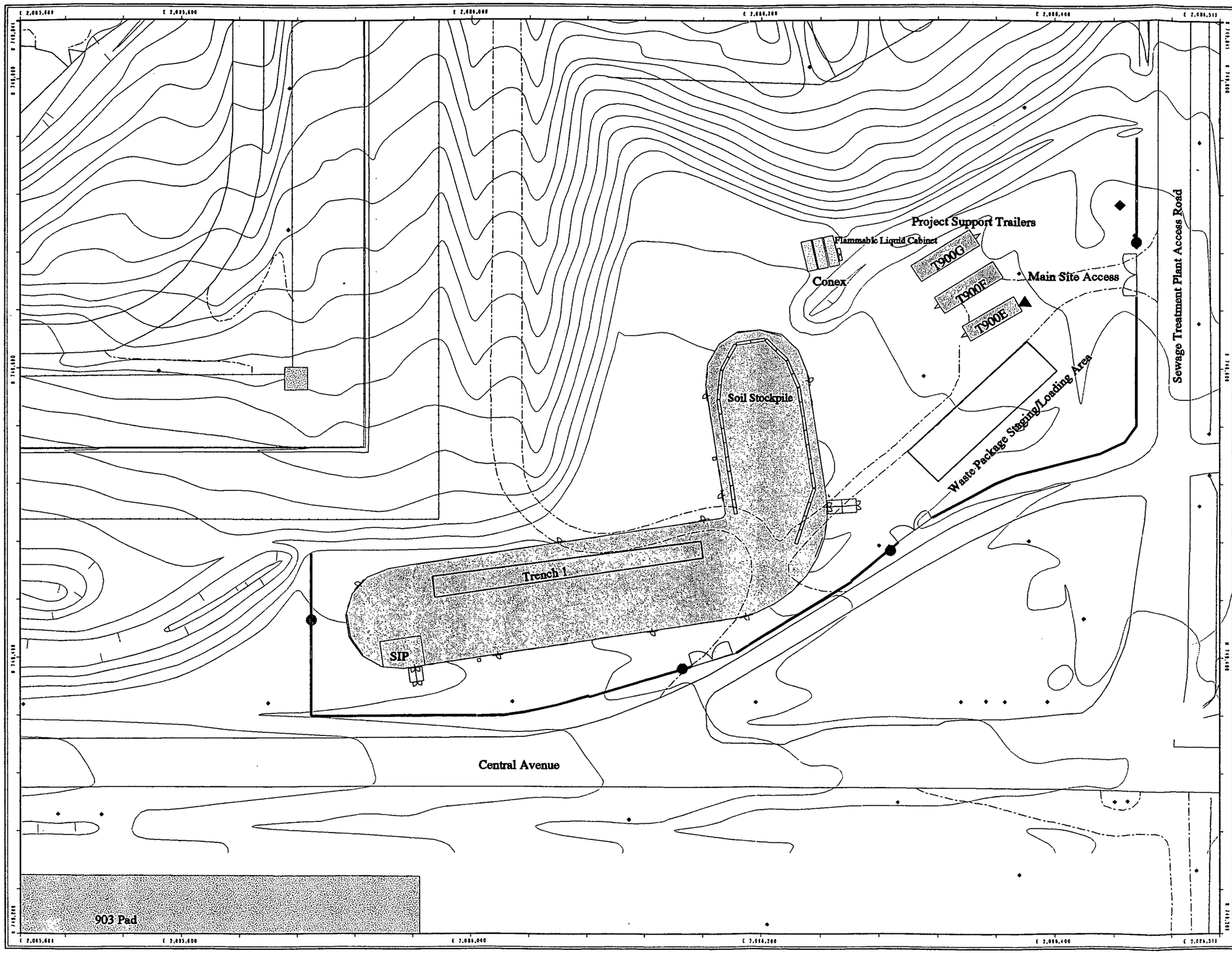
Trench 1
Site Layout
Figure 3.3



EXPLANATION

- Personnel Access Gate
- Personnel Accountability Tag Board
- Primary Assembly Area
- 2 Foot Contours
- Safety Fence
- Trench 1 Boundary
- Temporary Structure Boundary

SIP = Sampling and Inerting Pad

Standard Map Features

- Buildings and other structures
- Fences and other barriers
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs. 1/95

N

Scale = 1 : 770
1 inch represents approximately 64 feet

25 0 50 100ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
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P.O. Box 464
Golden, CO 80402-0464

MAP ID: 98-0115

April 29, 1998

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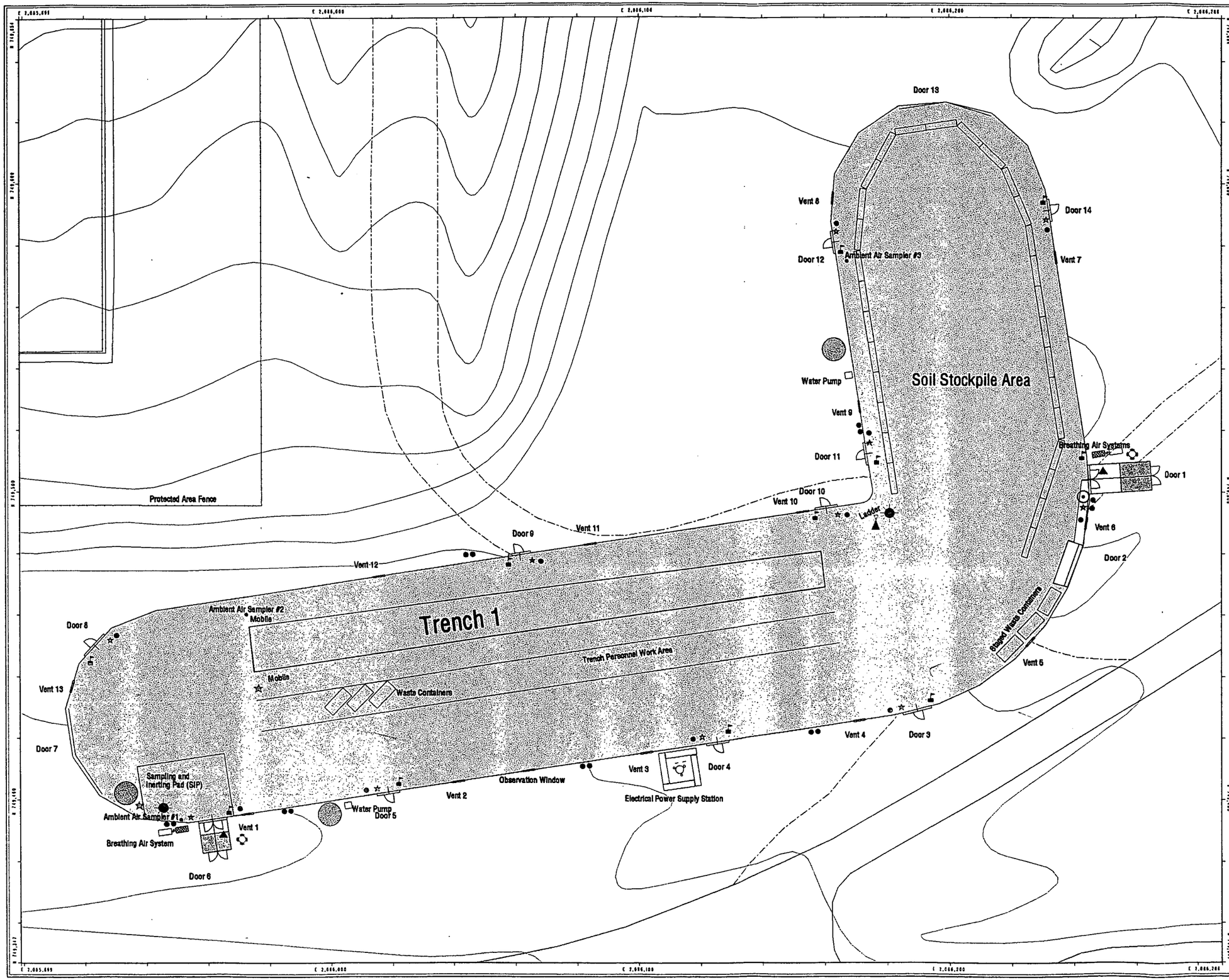
Trench 1
Temporary Structure Layout
Figure 3.4



EXPLANATION

- 2 Foot Contours
- Trench 1 Boundary
- Radiological Buffer Area/Contamination Reduction Zone
- Contamination Area/Exclusion Zone
- High Contamination Area/Exclusion Zone
- Non-Potable H_2O
- Waste Liquid Storage
- 20 lb Class ABC Dry Chemical Extinguisher
- 50 lb Class ABC Dry Chemical Extinguisher
- 15 Minute Continuous Flow Emergency Shower and Eye Wash Station
- Spill Kit
- Emergency Ventilation Shutdown Button
- Air Horn Alarm
- Electrical Outlet
- Continuous Air Monitor
- Ambient Air Sampler
- 30 lb Class D MET-L-X Extinguisher
- 150 lb Class D MET-L-X Extinguisher

Standard Map Features

- Fences and other barriers
- Paved roads
- Dirt roads

Scale = 1 : 370
1 inch represents approximately 31 feet

10 0 20 40ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
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Golden, CO 80402-0464

MAP ID: 98-0146

April 28, 1998

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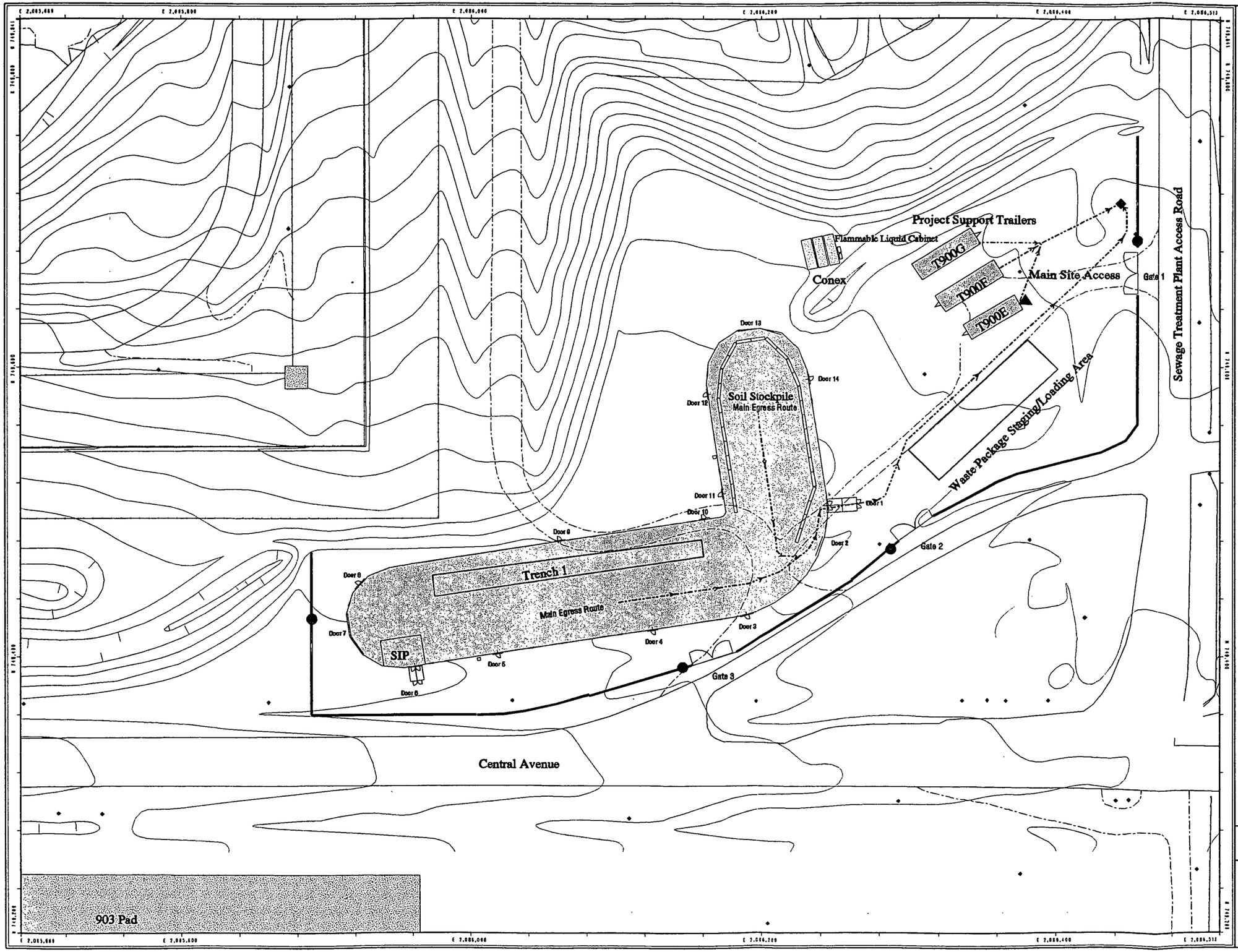
Trench 1
Emergency Response Map
Figure 9.1



EXPLANATION

- Personnel Access Gate
- Personnel Accountability Tag Board
- Primary Assembly Area
- 2 Foot Contours
- Safety Fence
- Trench 1 Boundary
- Temporary Structure Boundary

SIP = Sampling and Inerting Pad

Standard Map Features

- Buildings and other structures
- Fences and other barriers
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs. 1/95

N

Scale = 1 : 770
1 inch represents approximately 64 feet

25 0 50 100ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

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MAP ID: 98-0115

April 29, 1998

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